ASSESSING THE PREDICTIVE SENSITIVITY OF EARLY CHILDHOOD SCREENING VARIABLES TO IMPROVE PRE-K ELIGIBILITY DECISIONS

by

Andrew Paul Gadaire

A thesis submitted to the faculty of
The University of North Carolina at Charlotte
in partial fulfillment of the requirements
for the degree of Master of Science in
Psychology

Charlotte

2018

Approved by:

_____
Dr. Ryan Kilmer

_____
Dr. Jim Cook

_____
Dr. Margaret M. Quinlan

ABSTRACT

ANDREW PAUL GADAIRE. Assessing the predictive sensitivity of early childhood screening variables to improve pre-k eligibility decisions. (Under the direction of DR. RYAN P. KILMER and DR. JAMES R. COOK)

High-quality early childhood education, such as pre-kindergarten (pre-k) can help children develop the academic and social-emotional skills they need to succeed in school. Pre-k can be especially important for students at risk of starting elementary school behind their peers, helping them catch up to their peers by the time school begins and setting them on more positive educational and developmental trajectories. Many pre-k programs seek to identify children with the greatest need by collecting information about the child's functioning, the child's experiences in the home, and the child's family. While there is ample research connecting early childhood risk factors to school readiness, there is no standard method for using multiple risk factors to determine which children have the greatest need for pre-k and, therefore, should be accepted into a pre-k program. The present study seeks to improve our ability to predict children's school readiness, which is conceptualized here as language development (i.e., receptive vocabulary) and social-emotional functioning. Using hierarchical multiple regressions, the present study seeks to assess the extent to which early childhood variables collected during the Charlotte-Mecklenburg Schools (CMS) pre-k screening process predict child functioning at the beginning of pre-k. The results of these analyses 1) indicate the risk factors with the strongest relationships to receptive vocabulary and social-emotional functioning at the beginning of pre-k and 2) guide modifications to the CMS pre-k screening process and the formula used to determine eligibility.

DEDICATION

I would like to dedicate this work to my mother, Marsha Philips, father, Steve Gadaire, and step-father, Graham Philips. I have been blessed to learn from your love and compassion, as well as your dedication to improving the lives of others. I am especially thankful for the way you encouraged me to follow my heart, develop my own values, and pursue my goals; believing in me at every turn, even when I may not have believed in myself. Know that I would not trade my time with any of you for a lifetime with any other parent.

ACKNOWLEDGMENTS

I would like to acknowledge my advisors Dr. Ryan Kilmer and Dr. Jim Cook who have provided insight and support throughout the development of my thesis as well as my overall academic development. I would also like to thank Dr. Margaret M. Quinlan, who has provided additional feedback even while on maternity leave. In addition to my committee members, I would like to thank Julie Babb (Director of Charlotte-Mecklenburg Schools [CMS] Pre-K) and Cher Holcomb (CMS Pre-K Recruitment and Enrollment Coordinator), not only for allowing me to be involved in their work, but for sharing insight and expertise that guided this project. Finally, I would like to acknowledge the Institute of Education Sciences, which has funded the overarching partnership among the Community Psychology Research Lab at The University of North Carolina at Charlotte, the Charlotte-Mecklenburg Schools Pre-Kindergarten Program, and the Charlotte-Mecklenburg Schools Office of Accountability. Many thanks to all those mentioned here, as well as my family, friends, and colleagues for their continued support.

TABLE OF CONTENTS

LIST OF TABLES viii

LIST OF ABBREVIATIONS x

CHAPTER 1: INTRODUCTION 1

1.1. Conceptualizing School Readiness 2

1.2. The Impact of Early Childhood Education 3

1.3. Factors Contributing to the Impact of Early Childhood Education 6

1.4. Early Childhood Education and the Achievement Gap 7

1.5. Determining Eligibility for Pre-K 9

1.6. Family Income and Socioeconomic Disadvantage 10

1.7. Individual Characteristics Associated with Low School Readiness 12

1.8. Family Circumstances/Characteristics and Low School Readiness 14

1.9. The Context of the Present Study 20

1.10. The Present Study 21

1.11. Research Questions and Subcomponents 22

CHAPTER 2: METHOD 25

2.1. Participants 25

2.2. Measures 27

2.3. Procedure 31

2.4. Analytic Approach 33

CHAPTER 3: RESULTS 37

3.1. Predicting Receptive Vocabulary 39

3.2. Predicting Social-Emotional Protective Factors 42

3.3. Predicting Behavior Concerns 44

3.4. Improving the Screening Process: Data Collection and Management 46

3.5. Improving the Eligibility Formula 48

3.6. Revising the Formula through a Participatory Process 52

CHAPTER 4: DISCUSSION 60

4.1. Limitations 65

4.2. Contributions 67

4.3. Future Directions 68

4.4. Conclusion 70

REFERENCES 72

TABLES 86

APPENDIX A: SCREENER OBSERVATIONS CHECKLIST 107

APPENDIX B: PARENT INTERVIEW 109

APPENDIX C: PARENT SURVEY 111

APPENDIX D: COMPARISON OF ELIGIBILITY FORMULAS 112

LIST OF TABLES

TABLE 1: Descriptive statistics for screening measures.

TABLE 2: Item-level descriptive statistics: Parent interview and screener observations checklist.

TABLE 3: Descriptive statistics for pre-kindergarten indicators of functioning.

TABLE 4: Correlations between screening measures and pre-kindergarten indicators of functioning.

TABLE 5: Hierarchical multiple regression using screening scale scores to predict PPVT scores.

TABLE 6: Hierarchical multiple regression using screening item scores to predict PPVT scores.

TABLE 7: Unstandardized and standardized regression coefficients for all variables in step 5 of the hierarchical multiple regression predicting PPVT scores.

TABLE 8: Hierarchical multiple regression using screening scale scores to predict DECA Total Protective Factor scores.

TABLE 9: Hierarchical regression using screening items to predict DECA Total Protective Factors.

TABLE 10: Unstandardized and standardized regression coefficients for all variables in step 5 of the hierarchical multiple regression predicting DECA Total Protective Factors scores.

TABLE 11: Hierarchical multiple regression using screening scale scores to predict DECA Behavior Concerns scores.

TABLE 12: Hierarchical regression using screening items to predict DECA Behavior Concerns.

TABLE 13: Unstandardized and standardized regression coefficients for all variables in step 5 of the hierarchical multiple regression predicting DECA Behavior Concerns scores.

TABLE 14: Descriptive statistics for the composite school readiness variable.

TABLE 15: Hierarchical multiple regression using screening scale scores to predict school readiness at the beginning of pre-k.

TABLE 16: Hierarchical multiple regression using Brigance scores and screening items to predict school readiness at the beginning of pre-k.

TABLE 17: Final step of a Hierarchical multiple regression using Brigance scores and screening items to predict school readiness at the beginning of pre-k.

TABLE 18: Hierarchical multiple regression using Brigance scores and screening items to predict school readiness at the beginning of pre-k excluding variables with counter-intuitive weights.

TABLE 19: Estimation of the highest possible amount of variance in eligibility scores that could be explained by each predictor variable.

TABLE 20: Estimated effects of each variable for a child with a high Brigance score.

TABLE 21: Amount of variance accounted for by revised and original eligibility scores.

LIST OF ABBREVIATIONS

CMS	Charlotte-Mecklenburg Schools
SES	Socioeconomic Status
IOM	Institute of Medicine
NRC	National Research Council
GPA	Grade-point average
PPVT	Peabody Picture Vocabulary Test
DECA	Devereux Early Childhood Assessment
TPF	Total Protective Factors (DECA scale)
BC	Behavior Concerns (DECA scale)
UNC Charlotte	University of North Carolina at Charlotte
CPRL	Community Psychology Research Lab
SD	Standard Deviation
SO	Screener Observations
PI	Parent Interview
PS	Parent Survey
RQ1	Research Question 1
RQ2	Research Question 2
SDQ	Strengths and Difficulties Questionnaire
Z	Z-score
Brig	Brigance Score
Aud.	Auditory Concerns
SR	Self-Reliance Concerns
EF	Emotional Functioning Concerns
MS	Motor Skills Concerns
SS	Parental Social Support Concerns
P-C Activities	Lack of Parent Child Activities
DSS	Department of Social Services

CHAPTER 1: INTRODUCTION

High-quality early childhood education can help children develop the early academic and social-emotional skills they need to succeed in elementary school and beyond (Deming, 2009; Gormley, 2008; Heckman, Moon, Pinto, Savelyev, & Yavitz, 2010; Weiland & Yoshikawa, 2013; Yoshikawa, Weiland, & Brooks-Gunn, 2016). Early childhood education can be especially effective for students with low school readiness (i.e., students who are at risk of starting elementary school behind their peers). Notably, high-quality early childhood education has also been shown to significantly reduce the educational achievement gaps associated with race/ethnicity and income (Gormley, 2008; Puma, Bell, Cook, Heid, & Lopez, 2005; Weiland & Yoshikawa, 2013; Yoshikawa et al., 2016).

Due to limited capacity, most publicly-funded pre-kindergarten (pre-k) programs target students at the greatest need, often operationalized as children from low-income homes or those deemed at risk for not being ready for kindergarten (i.e., children evidencing the lowest school readiness as four-year-olds; Carolan & Connors-Tadros, 2015). However, school readiness is the product of a multitude of factors, and there is no standardized method for assessing or calculating school readiness based on these factors.

The present study seeks to improve our understanding of school readiness by examining the extent to which early childhood screening variables collected by Charlotte-Mecklenburg Schools (CMS) predict students' school readiness at the beginning of pre-k. In this study, school readiness is conceptualized as early language skills and social-emotional development. Assessing the predictive sensitivity of CMS screening variables as they relate to academic and social-emotional functioning in pre-k can help CMS

identify potential improvements to the pre-k eligibility screening process. Such work can also advance our understanding of the interrelated variables that contribute to school readiness in early childhood. The next sections of this paper provide an overview of 1) the documented effects of high-quality early childhood education, 2) the factors that influence school readiness, and 3) how pre-k eligibility (i.e., lack of school readiness) is determined in CMS schools.

Conceptualizing School Readiness

School readiness refers to the extent to which children possess the cognitive and social-emotional skills needed to succeed in elementary school, starting at kindergarten entry. Even before kindergarten, researchers have identified gaps in school readiness that are associated with socioeconomic status (SES), race/ethnicity, and a variety of environmental factors (Institute of Medicine [IOM] & National Research Council [NRC], 2012). Critically, these gaps in readiness have implications for students and their educational and personal trajectories (Duncan et al., 2007; Jones, Greenberg, & Crowley, 2015). For instance, academic and social-emotional challenges are likely to persist through kindergarten and elementary school for students who are behind their peers at the beginning of kindergarten, which can contribute to long-term consequences such as poor academic performance, low educational attainment, lower occupational attainment, poor mental health, and higher likelihood of being involved in criminal activity (Duncan et al., 2007; Jones et al., 2015; Pears et al., 2014; Yoshikawa et al., 2016).

Framed by the ecological perspective (Bronfenbrenner, 1979), school readiness is developed through children's interactions with parents, family members, peers, neighbors, and teachers, which may be influenced by a host of environmental factors in

the home, school, neighborhood, or community (Mashburn & Pianta, 2006; Sheridan, Knoche, Edwards, Bovaird, & Kupzyk, 2010). Therefore, when attempting to predict school readiness, it would be optimal to assess and consider factors and conditions at each of these levels.

The Impact of Early Childhood Education

High-quality early childhood education provided through pre-k classes has been linked to a diverse range of positive outcomes. For instance, Weiland and Yoshikawa (2013) suggest that participation in a high-quality pre-k program equips children with the academic and social-emotional skills needed to succeed in kindergarten and throughout elementary school. Consistent with that notion, students who attend high-quality preschool programs have shown stronger development of reading, writing, receptive vocabulary, and mathematics skills (Gormley, 2008; Weiland & Yoshikawa, 2013). A national evaluation of Head Start, a federally-funded early childhood education program designed to prepare low-income children for school, also indicated small to moderate improvements in pre-reading, pre-writing, vocabulary, and parent-reported literacy skills as a result of the program (Puma et al., 2005).

Beyond benefits for the development or enhancement of academic and pre-academic skills, early childhood education has also been related to improved social-emotional functioning in kindergarten, although the magnitude and persistence of social-emotional effects are unclear. That said, the weight of the evidence suggests that quality early childhood education experiences contribute to both short- and long-term social-emotional benefits (Heckman, Pinto, & Savelyey, 2013, Jones et al., 2015). As one example, in their study of a publicly-funded pre-k program in Boston, MA, Weiland and

Yoshikawa (2013) found that students who attended pre-k programs showed stronger executive functioning and emotional development at the beginning of kindergarten than students who did not attend preschool. Overall, findings from the extant literature suggest that high-quality early childhood programs can lead to short-term gains in social competence, behavior, peer relationships, and caregiver relationships, in addition to academic gains and improved school competence (Conner & Fraser, 2011). Moreover, results from multiple efforts suggest that preschool participation is associated with reduced timidity, improved attentiveness, and reduced problem behaviors and hyperactive behavior (Gormley, Phillips, Newmark, Welti, & Adelstein, 2011; Puma et al., 2005).

Overall, high-quality preschool education appears to have intermediate- and long-term effects on development as well. For instance, reading, math, and attention skills at the beginning of kindergarten were found to be strong predictors of student performance on fifth-grade achievement tests (Claessens, Duncan, & Engel, 2009; Duncan et al., 2007). Although some research suggests that preschool gains (particularly those reflecting cognitive or academic skills) dissipate over the course of elementary school (by as early as 2nd or 3rd grade), other studies suggest that participation in pre-k is associated with improved high school grade-point average (GPA) and graduation rates (Heckman et al., 2010; Yoshikawa et al., 2016). Consistent with the latter reports, Deming (2009) found the long-term effects of Head Start to be even stronger than short-term gains, suggesting that, relative to a comparison group that did not participate in Head Start, program participants were 9% more likely to graduate from high school, 7% more likely to attend college, and 7% less likely to have poor health in young adulthood. Thus, it

appears that quality early childhood education can have positive effects that extend beyond cognitive/academic and social-emotional competencies.

In that vein, longitudinal efforts have shown that early childhood education can improve a diverse range of health behaviors (e.g., improved diet, increased physical activity, reduced smoking and alcohol consumption, higher probability of having health insurance) and health outcomes (e.g., lower hypertension and blood pressure) between ages 27 and 40 (Conti, Heckman, & Pinto, 2016). Preschool participation has also been related to increased employment and reduced criminal activity (Heckman et al., 2010; Heckman et al., 2013; Yoshikawa et al., 2016). Furthermore, in a long-term follow-up comparing individuals who had been in an innovative, high-quality early childhood education program and a matched comparison group, Heckman et al. (2010) found that the per person cost of criminal activity was significantly lower for those in the early childhood education condition. Taken together, these findings suggest that early childhood education is not only beneficial for preschool participants, but for society as a whole.

The empirical evidence supporting high-quality early childhood education advances the underlying assumption that children will be more likely to achieve better outcomes in their k-12 education (and beyond) if they possess certain competencies at the beginning of school, such as language, mathematics, attention, and social-emotional skills (Yoshikawa et al., 2016). These findings have stimulated research about the specific mechanisms through which early childhood interventions have such substantial effects on human development.

Factors Contributing to the Impact of Early Childhood Education

Although the benefits of quality early childhood education are multiply-determined, an important factor relating to early childhood education's impact on school readiness, as well as the short- and long-term benefits of school readiness, is the brain's rapid development and increased neuroplasticity during early childhood, especially in regard to cognitive (i.e., language, literacy, and math), social-emotional (i.e., social skills, emotion regulation), and executive functioning (i.e., decision making, voluntary control of attention and behavior) capacities (Sripada, 2012; Yoshikawa et al., 2016). Early childhood experiences shape the architecture and functioning of the brain, which can lead to more dramatic effects later in life (Institute of Medicine & National Research Council, 2012).

More specifically, in early childhood, the brain structures that influence emotion regulation, language, executive functioning, mental health, and coping are developed, strengthened, and may even become permanent (Bick, Fox, Zeanah, & Nelson, 2017; Sripada, 2012). Of particular salience here, interactions between the child and his or her environment influence how the brain develops and how the child responds to new stimuli in the future (Masten & Cicchetti, 2010). These interactions, and their effects, can contribute to developmental cascades or cascading effects (Masten & Cicchetti, 2010) that, at their core, reflect how positive or negative experiences in early childhood could impact child development, directly or indirectly, in various domains (i.e., cognitive, social-emotional, physical, etc.). Once initiated, developmental cascades could set off a chain reaction (or 'snowball' effect) that increases the likelihood of positive or negative outcomes later in life (Masten & Cicchetti, 2010). Early childhood education may have

strong effects on proximal and distal developmental outcomes because it interrupts negative cascades (e.g., the effects of low socioeconomic status), and/or initiates positive cascades at an early age (Heckman, 2006; Masten & Cicchetti, 2010).

Early Childhood Education and the Achievement Gap

In addition to improving school readiness, high-quality early childhood education can reduce the achievement and behavior gaps associated with differences in parental education, family income, and race/ethnicity (Yoshikawa et al., 2016). Such disparities could stem from a variety of factors, including health conditions, access to educational materials, exposure to violence and other adversities, and limited parental engagement. However, it is encouraging that early childhood education has shown the strongest effects for marginalized youth. As one case in point, in their evaluation of a publicly-funded pre-k program in Boston, MA, Weiland and Yoshikawa (2013) found that "children who were eligible for free or reduced lunch benefited significantly more than those who were ineligible" (p. 2123), especially in literacy, vocabulary, and math. Multiple efforts suggest that children from marginalized or disadvantaged groups (i.e., children who are Black, Latino, or from low-income backgrounds) have shown greater gains over the course of the preschool year. For example, research has documented stronger positive effects of high-quality preschool programs for Hispanic children compared to non-Hispanic children (Gormley, 2008; Weiland & Yoshikawa, 2013).

Early childhood education may have the strongest effects on achievement gaps associated with socioeconomic status (SES), as evidenced in a study conducted by Bassok (2010) that found no racial differences in the effects of preschool when controlling for SES. The Head Start impact study conducted by Puma et al. (2005)

indicated that participation in Head Start cut the pre-reading achievement gap in half for children from low-income families. Head Start was also found to significantly reduce achievement gaps in pre-writing scores and vocabulary, while having a nonsignificant effect reducing the gap in problem behavior and hyperactivity (Puma et al., 2005). As another example, one effort found that Head Start had stronger long-term effects on African American children and children from more disadvantaged backgrounds (Deming, 2009). Across this research area, the evidence suggests that early childhood education can have positive long-term effects in addition to short-term benefits, especially for children from disadvantaged backgrounds.

Participation in an early childhood education program has been shown to be a stronger predictor of early reading, writing, and math skills than various other characteristics (i.e., race, ethnicity, SES, maternal education, and living in a single-parent home), suggesting that early childhood education helps children from at-risk backgrounds "catch up" with and even surpass their peers (Gormley, 2008). Early childhood education not only has a significant impact on short-term academic gains and school readiness but may also protect youth from the negative developmental consequences associated with various family and environmental risk factors.

Despite the protective (and promotive) effects of early childhood education, large segments of the US population continue to lack access to pre-k (IOM & NRC, 2012). Due to capacity limitations, many publicly-funded preschool programs are designed to target children with the greatest risk of starting school behind their peers academically, socially, or emotionally (Carolan & Connors-Tadros, 2015). However, identifying the children who have the greatest need for preschool is challenging because low school

readiness results from a range of complex, interrelated factors that occur at the individual, family, and community levels.

Determining Eligibility for Pre-K

Predicting school readiness involves assessing a child's academic, social, and emotional competencies at a young age to determine whether that student is prepared to begin school. If a child appears to be functioning below the norm in any of these areas, he or she may struggle in kindergarten with academic deficits that could continue to grow through elementary school. Identifying at-risk students at a young age can help us understand which students would benefit most from preschool. However, accurate data about a child's academic skills and social-emotional functioning are not readily available for most 3- and 4-year-olds. For this reason, many pre-k programs administer screenings and collect data on family and environmental risk factors in order to estimate each child's school readiness, which ultimately determines their eligibility for the program. According to the Center on Enhancing Early Learning Outcomes (2015), "eligibility policies must balance accountability for public funds with the need to provide efficient and flexible processes to document risk factors" (p. 1).

There is variance in the assessments and predictors used across programs to estimate school readiness. Some schools may assess the child's pre-academic skills (i.e., literacy, language, vocabulary, and mathematics) to estimate the child's educational development and provide a more direct estimate of school readiness. Other early childhood programs determine eligibility based on the underlying factors that appear to influence school readiness, such as family income, parents' level of education, ethnicity, home language, parenting behaviors, and family circumstances (i.e., homelessness and

single-parent homes; Carolan & Connors-Tadros, 2015). These risk factors may continue to influence academic and social-emotional outcomes throughout school, producing challenges that are not revealed in a pre-academic screening. Research suggests that the likelihood of negative effects (i.e., low school readiness) is compounded when children experience multiple risk factors (Carolan & Connors-Tadros, 2015; Farmer & Farmer, 2001). The remainder of this section provides an overview of research regarding various risk factors connected to school readiness and how information about these risk factors has been used to inform eligibility decisions.

Family Income and Socioeconomic Disadvantage

Low-income status is the factor most frequently used to determine eligibility for publicly-funded pre-k (Carolan & Connors-Tadros, 2015). While some programs rely solely on income to determine eligibility, most use income in combination with other factors. In this context, family income is usually compared to either the Federal Poverty Level or the State Median Income. When comparing family income to the Federal Poverty Level, the cutoff most commonly used to qualify as a risk factor is 185% of the Federal Poverty Level or less (Carolan & Connors-Tadros, 2015). This percentage is also the cutoff used to determine eligibility for free- or reduced-price lunch (Carolan & Connors-Tadros, 2015).

Many studies have shown that low-income status has a negative impact on early childhood development and school readiness. Data from the Early Childhood Longitudinal Study-Birth Cohort (ECLS-B) suggest that young children (age 0-3) growing up in low-income families tend to show poorer cognitive development than children from middle- and upper-class families (Halle et al., 2009). Low-income status

has also been found to be negatively associated with academic skills, such as literacy development and language ability, at the beginning of kindergarten (Forget-Dubois et al., 2009; Lazarte-Alacla, Salehezadeh, & Schumacher, 2013). Duncan and Magnuson (2011) provided more precise estimates of the income-based school readiness gap, suggesting that students from low SES backgrounds scored 1.34 standard deviations below high-SES students in early-math skills, .63 standard deviations lower in teacher-rated attentiveness, and .26 standard deviations worse in antisocial behavior (i.e., suggesting more antisocial behavior). Duncan and Magnuson (2011) also found that each of these gaps increased over the course of elementary school.

Although there is vast evidence linking SES to cognitive and social-emotional development, it is important to note that low-SES typically co-occurs with multiple other environmental factors, family characteristics, and neighborhood characteristics (see Jiang, Granja, & Koball, 2017). The concept of correlated constraints suggests that development is impacted by a system of risk factors and positive/promotive factors; that is, contextual factors can cluster or hang together to exert, in combination, positive or negative influences on children's adjustment trajectories (see Farmer & Farmer, 2001). Thus, if this system includes more positive factors than risk factors, the individual may be able to avoid the negative consequences of risk factors (Farmer & Farmer, 2001). However, if the individual primarily experiences risk factors, it is more likely that these factors will interact to have a negative effect on development and limit the impact of positive influences (Farmer & Farmer, 2001). This concept demonstrates how the multiple risk factors associated with low-SES could work together to decrease school

readiness and negatively affect child development more broadly (Bassuk, 2010; Forget-Dubois et al., 2009; Lapointe, Ford, & Zumbo, 2007).

Individual Characteristics Associated with Low School Readiness

This section will provide a brief overview of the research on individual characteristics that influence the child's ability to succeed in kindergarten. These characteristics can be measured through one-on-one assessments with the child, which can provide a direct indication of how that child will function in school.

Pre-academic skills. Assessing pre-academic and cognitive skills, such as language development, literacy, and mathematics, can help identify academic shortcomings or developmental delays. Understanding these challenges can help determine whether a child is at-risk of starting kindergarten behind their peers and may benefit from early childhood education (Glascoe, 2010). Valid and reliable measures, such as the Brigance Early Childhood Screens (2014) can serve as useful screening tools for pre-k programs. However, brief assessments may not be able to detect challenges that will arise for children from at-risk backgrounds and, as a result, may inadequately predict school readiness. For this reason, pre-academic assessments should be supplemented by other sources of information that shed light on the contextual factors that influence the child's development (e.g., information from caretakers; Mantzicopoulos, 1999).

Social-emotional development. The development of social-emotional skills is another important factor that influences the likelihood of educational success. However, a report that synthesized information based on screening and assessment of young children indicated that only 40% of children possess the social-emotional competence to succeed in kindergarten, compared to 60% with the necessary cognitive skills (Yates et al., 2008).

That finding is noteworthy because multiple efforts have pointed to the salience of different elements of social-emotional functioning for children's performance and growth in educational and early care settings. For example, research suggests that confidence, emotion regulation, identity, and social skills can all influence a child's ability to learn and succeed academically (Yates et al., 2008). Moreover, children who process social information more effectively tend to show improved behavior, attitudes toward learning, and school readiness overall (Ziv, 2013). Similarly, self-regulation, behavior problems, and emotion recognition have each shown strong relationships to academic school readiness as well (Eisenberg, Valiente, & Eggum, 2010; Montes, Lotyczewski, Halterman, & Hightower, 2012; Nelson, Welsh, Trup, & Greenberg, 2011).

Social-emotional functioning in kindergarten (e.g., social competence, teacher-rated aggression, etc.) has also been associated with outcomes in young adulthood, such as education, employment, criminal activity, substance use, and mental health (Jones et al., 2015). The fact that research has shown that early interventions such as high-quality early childhood education can improve social-emotional development highlights the importance of identifying students with social-emotional needs and addressing those needs (Conner & Fraser, 2011; Shonkoff & Phillips, 2000; Weiland & Yoshikawa, 2013).

Developmental delay/disability. Identifying developmental delays or disabilities is an important step to ensuring that students receive needed services. Challenges involving gross- and fine-motor skills, communication skills (e.g., speech impediments, hearing difficulties, etc.), learning disabilities, and physical health concerns can impact a child's ability to learn and succeed academically (Carolan & Connors-Tadros, 2015; Mantzicopoulos, 1999). To this end, students with disabilities tend to score below

average on measures of emergent literacy, vocabulary, math, and social skills (Carta, 2014). However, quality pre-k experiences appear to improve outcomes for children with disabilities, as shown by the National Early Intervention Longitudinal Study (Carta, 2014), which found that half of the pre-k students expected to require special education services in kindergarten did not require those services and performed in a manner similar to their peers in reading and math. Results from this effort indicated that early interventions targeting social skills and communication skills were especially effective for children with disabilities.

Family Circumstances/Characteristics Associated with Low School Readiness

Research has documented the relevance of a host of family circumstances or characteristics of the family environment for the functioning of young children and their subsequent readiness for school. The next paragraphs briefly describe selected contextual variables reflecting such aspects of the family (or caregiving) context.

Homelessness or housing instability/mobility. Homelessness can be defined as lacking a "fixed, regular, and adequate nighttime residence" (Aratani, 2009, p. 3). In a literature review conducted by Murphy (2011), the experience of homelessness was connected to higher absenteeism; lower academic skills in reading, spelling, and math; and significantly lower graduation rates. Furthermore, among low-income families, housing instability in early childhood (i.e., moving three or more times in the first five years of life) is associated with greater attention difficulties and higher levels of problem behaviors for 5-year-old children (Ziol-Guest & McKenna, 2014). Overall, the extant evidence suggests that experiencing homelessness or housing instability can lead to a range of negative physical and mental health outcomes (e.g., Post-Traumatic Stress

Disorder, substance use), poor emotion regulation, delayed developmental milestones, negative social influences (i.e., peer groups), and juvenile delinquency (Aratani, 2009; Bassuk, 2010). Consistent with these negative consequences, homelessness or housing instability can significantly reduce a child's ability to succeed in school (Murphy, 2011; also see Kilmer, Cook, Crusto, Strater, & Haber, 2012).

Children of teen parents. Children whose mothers gave birth to them at age 19 or younger are more likely to have developmental delays, perform worse on cognitive ability tests, and have lower scores in reading, math, and verbal assessments in early childhood (Daily, Welti, Forry, & Rothenberg, 2012; Ryan-Krause, Meadows-Oliver, Sadler, & Swartz, 2009). Later in life, children of teen parents are more likely to repeat a grade, drop out of high school, be incarcerated during adolescence, and become teen parents themselves (Levine, Pollack, & Comfort, 2001; Ryan-Krause et al., 2009). However, low-income status and low maternal education are common covariates of teen parenthood, so the extent to which teen parenthood produces these effects alone is unclear (Carolan & Connors-Tadros, 2015).

Maternal education. Another variable associated with income and the age of becoming a parent is maternal education. Ziol-Guest and McKenna (2014) found that maternal education was the strongest predictor of young children's literacy and language development (operationalized by the Peabody Picture Vocabulary Test and the Woodcock-Johnson Letter-Word Identification test), even when controlling for housing instability, the age of the mother, single-parent households, and SES. Across studies, lower maternal education has been associated with a range of outcomes, including lower

school readiness, educational achievement, and social-emotional functioning (Daily et al., 2012).

Children in single-parent households. Children in single-parent families are more likely to experience housing instability, poverty, and poor social-emotional development (Daily et al., 2012). Each of these factors has a negative impact on school readiness and may have consequences for child development more broadly.

Exposure to domestic or interpersonal violence. Exposure to violence refers to being the victim of physical or sexual abuse, witnessing violence in the home (i.e., domestic violence), or witnessing violence in the community (Kaufman, Ortega, Schewe, & Kracke, 2011). Beyond the possibility of physical harm, exposure to violence has been linked to short- and long-term social-emotional consequences such as depression, anxiety, low self-esteem, behavior problems, poor emotion regulation, and low-quality relationships with peers and adults (Kaufman et al., 2011; Kitzmann, Gaylord, Holt, & Kenny, 2003; Margolin & Gordis, 2004; Osofsky, 2003; Rigterink, Fainsilber Katz, & Hessler, 2010). Exposure to violence has also been linked to cognitive delays and academic challenges (Kaufman et al., 2011; Kitzmann et al., 2003; Margolin & Gordis, 2000). These effects seemingly reflect inhibition of early childhood brain development due to the stress associated with harmful environmental conditions and exposure to violence (Greenough, Black, & Wallace, 1987; Rigterink et al., 2010). Identifying children who have been exposed to violence and addressing their social-emotional challenges in an early childhood education setting may help reduce negative outcomes.

Foster care. Many children in foster care are exposed to violence or other early childhood adversities such as neglect in the context of their caregiving environments,

which can affect the child's academic and social-emotional development (Bucci, Marques, & Harris, 2016). In the face of such adverse events, the support these children receive may be especially important to their development (American Academy of Pediatrics, 2000). If children do not receive this support, or if trauma or neglect continues, the effects of the initial trauma may be exacerbated (American Academy of Pediatrics, 2000). Furthermore, many children in foster care are placed with multiple families during childhood, which could potentially lead to the consequences associated with housing instability. Instability could create another barrier to overcoming early childhood adversities.

Non-English speaking households. For some students, school is their first experience with the English language. In fact, youth from Spanish-speaking homes represent the most rapidly growing segment of the student population in the US (National Center for Education Statistics, 2007). Without language-related support and attention, children from Spanish-speaking homes can face challenges in English language and literacy performance. For instance, on average, reading comprehension in this population at age 11 is one standard deviation (approximately 2.5-grade levels) below the norm (Mancilla-Martinez & Lesaux, 2010; Nakamoto, Lindsey, & Manis, 2008). This gap may result from delayed development of word reading, vocabulary, and oral language skills (Mancilla-Martinez & Lesaux, 2010). However, D'Angiulli, Siegel, and Maggi (2004) found that English language learners in early childhood education programs develop literacy skills on par with students who speak English as their first language by the time they start kindergarten. As one example, Gormley (2008) found that a high-quality pre-k program in Oklahoma not only led to meaningful improvements in language and reading

skills for Hispanic students but also contributed to gains in other cognitive domains, such as writing and math. Overall, there is evidence to support identifying English language learners (or English as a Second Language students) for publicly-funded pre-k programming, as a strategy for facilitating their school readiness (Bassok, 2010; Gormley, 2008).

Screen time. Screen time refers to time spent watching television, using a computer, playing video games, and using smartphones or tablets. Screen time appears to have a negative impact on child development in many ways. For instance, young children who use electronic media more frequently are more likely to experience negative physiological outcomes, such as weak gross motor skills, obesity, and lower quality sleep (Domingues-Montanari, 2017). Screen time can also have a negative impact on school readiness in terms of language development, vocabulary, and pre-math skills (Byeon & Hong, 2015; Pagani, Fitzpatrick, & Barnett, 2013). In addition to these negative effects, research has documented an association between use of electronic media in early childhood and emotional reactivity, aggression, and behavior problems (Chonchaiya, Sirachairat, Vijakkhana, Wilaisakditipakorn, & Pruksananonda, 2015; Pagani et al., 2013). Furthermore, if screen time replaces interactions with parents or caregivers, it can have negative implications for social relationships and communication skills (Lagercrantz, 2016; Zimmerman, Christakis, & Meltzoff, 2007).

However, the effects of screen time on child development may depend on the content of the program. Educational television shows (e.g., *Sesame Street*) and some video games have been associated with improved motor skills, prosocial behavior, and language development (Anderson & Pempek, 2005; Gentile et al., 2009; Okagaki &

Frensch, 1994). Despite the potential benefits of certain types of media, the American Academy of Pediatrics, Council on Communications and Media (2016) suggest that children below the age of two should not be exposed to electronic media, and children between the ages of two and five should only use electronic media for one hour or less per day.

Reading/access to educational materials. Reading to young children more frequently is related to stronger early language skills such as letter knowledge and vocabulary (Britto, Brooks-Gunn, & Griffin, 2006; Scarborough & Dobrich, 1994). In accord with such findings, Britto et al. (2006) found that encouraging child participation in reading activities can lead to greater improvements in language development and school readiness. In a longitudinal study assessing the effect of the home environment on preschool children's academic development, Weigel and colleagues (2006) found that when parents engaged in intentional language-focused activities (e.g., reading aloud, providing picture books, etc.) with their children more often, children showed improved letter knowledge and greater interest in reading.

Parental engagement in child development. Parental engagement, including parental warmth and sensitivity, support for emerging autonomy, and active participation in learning, has been related to social-emotional and cognitive development (Sheridan et al., 2010). For example, parental warmth and sensitivity are associated with improved social relationships, cognitive skills, language skills, and long-term academic performance (Downer & Pianta, 2006; Guralnick, 2008; Hirsh-Pasek & Burchinal, 2006). Support for autonomy is positively related to cognitive skills, communication skills, self-regulation, and initiative (Mulvaney, McCartney, Bub, & Marshall, 2006; Martinez,

1987; Neitzel & Stright, 2003). Parental participation in learning contributes to academic performance, prosocial behavior, and positive attitudes about learning (Weigel, Martin, & Bennett, 2006; McWayne, Fantuzzo, Cohen, & Sekino, 2004). Multiple parenting interventions have effectively improved each of these dimensions of parental engagement (Sheridan et al., 2010). A lack of parental engagement can lead to reduced school readiness if no intervention is provided.

Immigration status, incarceration of a parent, and military status are among the other family-level variables commonly used in early childhood screenings. To avoid burdening the family as well as the school system, most pre-k programs do not collect data on all of the risk factors presented here. Instead, the Center on Enhancing Early Learning Outcomes (2015) advises programs to collect data on no more than ten risk factors that may be relevant in their community.

The Context of the Present Study: Determining Pre-K Eligibility in Charlotte-Mecklenburg Schools

Charlotte-Mecklenburg Schools (CMS) pre-kindergarten serves almost 4,000 students per year through two pre-k programs: NC Pre-K and Bright Beginnings. All children and families referred to or seeking enrollment in one of these programs go through a brief but in-depth screening process, which includes the administration of the Brigance III Early Childhood Screening (2014), a parent survey, a structured parent interview, and observations made by the screener (CMS Pre-Kindergarten, 2016). These measures are described in greater detail in the Method section below.

Students are eligible for the NC Pre-K if their families' gross income is below 75% of the state median income in North Carolina (CMS Pre-Kindergarten, 2016). While

NC Pre-K serves roughly 1000 children who are at-risk based on their families' level of income, Bright Beginnings targets roughly 3000 children who appear to be behind their peers in their pre-academic or social-emotional development. That is, eligibility for Bright Beginnings is determined by the scores on the screening measures and the conclusion that, on the basis of these indicators, children are behind their same age peers and at-risk of not being ready for kindergarten. Currently, composite scores from each of the screening measures are weighted and entered into a formula that calculates the total eligibility score for each child. This formula is used to quantify an estimate of school readiness or risk of beginning elementary school behind their peers.

Through the use of multiple screening measures, the CMS Pre-kindergarten Program collects data on students' cognitive, pre-academic, and social-emotional capabilities, as well as selected environmental risk factors, to gauge school readiness. In effect, CMS is collecting data on child functioning and various risk factors and using those data to predict which students have the greatest need for, and could benefit most from, high-quality early childhood education. However, there is not an agreed-upon, standardized method of consolidating these data points and risk factors into an overall, school-readiness score, nor is there clarity regarding an optimal approach for using these variables together to determine eligibility.

The Present Study

The present study aimed to improve our understanding of school readiness by examining the extent to which early childhood screening variables collected by Charlotte-Mecklenburg Schools (CMS) predict students' cognitive abilities and social-emotional functioning at the beginning of pre-k. In this study, school readiness is defined by

students' early language skills and social-emotional functioning, which are operationalized as students' scores on the Peabody Picture Vocabulary Test (PPVT) and the Devereux Early Childhood Assessment (DECA), respectively. The purpose of this study is to understand the predictive sensitivity of CMS screening variables as they relate to academic and social-emotional functioning at the beginning of enrollment in pre-k.

Research Questions and Subcomponents:

This study was guided by two main questions, with multiple subcomponents:

1. To what extent do screening data predict receptive language skills (PPVT) and social-emotional functioning (DECA) at the beginning of pre-k?
    a. Taken together, to what degree does the information collected at the time of screening predict receptive language skills and social-emotional functioning at the beginning of pre-k?
    b. To what extent does each screening scale or screening item uniquely predict receptive language skills and social-emotional functioning at the beginning of pre-k?
2. How can the Bright Beginnings screening process and eligibility formula be improved, based on the degree to which the screening data predict receptive language skills and social-emotional functioning at the beginning of pre-k?
    a. Which screening items or elements should be removed or modified (and what should be added) in order to improve predictions of school readiness at the beginning of pre-k?
    b. How can the formula for eligibility be improved to better predict school readiness at the beginning of pre-k? That is, how does a data-driven formula

perform in predicting school readiness when compared to the current eligibility formula?

i. Additionally, how can a data-driven formula be modified using the expertise of Bright Beginnings leadership and staff, such that a revised formula can be implemented to meet program needs?

By addressing these questions, the present study seeks to enhance our understanding of the extent to which early language and social-emotional skills are related to individual and family characteristics as well as the broader home environment. In addition, estimating the weights that should be used for each screening variable could help early childhood programs, such as Bright Beginnings, utilize the screening data they collect to make informed decisions about which students should be admitted into the program.

To achieve these goals, analyses aimed to assess the unique contribution of each scale, as well as each individual item on the parent interview and screener observation (described in Measures), in predicting pre-language skills (i.e., PPVT scores) and social-emotional development (DECA Total Protective Factors scores and DECA Behavior Concerns scores; see Measures). Analyses were designed to improve our understanding of how the assessed factors predict subsequent performance in pre-k.

Growing out of this goal, the results of these analyses would be used to inform recommendations for improving the Bright Beginnings screening process. Analyses were also designed to guide the revision and standardization of the formula used to determine eligibility for Bright Beginnings. Although the weights allocated to each variable would ultimately be determined by Bright Beginnings leadership, the findings of the present

study aimed to inform those decisions by demonstrating the variable weights that would maximize our ability to predict school readiness in the research sample.

CHAPTER 2: METHOD

The present study falls within the scope of a broader partnership among the UNC Charlotte Community Psychology Research Lab (CPRL), the CMS Pre-k Department, and the CMS Office of Accountability. This collaborative effort, "Increasing the Capacity of Early Childhood Education Programs to Use Data to Improve Implementation and Evaluation," was funded by the Institute of Education Sciences and approved by the Institutional Review Board at the University of North Carolina at Charlotte on January 11, 2018. All data used in this study were either collected by the CPRL or shared with the CPRL as part of the larger collaborative effort.

Participants

Between November 2015 and October 2016, trained CMS pre-k program staff screened over 5,000 children in Mecklenburg County for eligibility to begin public preschool (i.e., Bright Beginnings or NC pre-k) in the fall of 2016. Of this population, 2,818 children were selected for and participated in Bright Beginnings. Parental consent to use student DECA and PPVT data for research was provided for 1385 students. Participants were excluded from the present effort if DECA, PPVT, or screening data were not available. The final research sample consisted of 1,180 students.

The research sample consisted of 43% girls, with a racial and ethnic make-up (as provided by CMS) of 44% Hispanic/Latino, 38% Black/African American, 8% White, 8% Asian, 2% multi-racial, and .5% American Indian. On average, there were 4 people per family (*SD* = 1.27), and the average per person income per year was $8,189.63 (*SD* = $7,454.93). In addition, the children came from homes with incomes that, on average,

were 140% of the 2016 federal poverty standards (*SD* = 113.65). Multiple languages were spoken in 42% of participants' homes.

Compared to the total population of 2016-2017 Bright Beginnings students, the research sample contained a slightly smaller proportion of Hispanic/Latino students (.6% less) and a slightly larger proportion of White students (.2% greater); these differences were not significant. The average yearly per person income and average percent of poverty were significantly higher in the research sample (approximately $550 and 10% greater). There were no significant differences between the research sample and the total population of 2016-2017 Bright Beginnings students on any of the screening factors (e.g., Brigance scores, parent interview items), DECA subscale scores, or PPVT scores, suggesting that the research sample is an adequate representation of the total population in Bright Beginnings.

Compared to the non-research sample (i.e., Bright Beginnings students who did not participate in the present study), students in the research sample were significantly more likely to demonstrate risk in physical appearance (i.e., unhealthy appearance as indicated on the screener observations checklist) and in the amount of screen time reported (i.e., more than two hours of screen time per day as reported on the parent interview). Students in the research sample also scored significantly higher on the PPVT at the beginning of pre-k. However, PPVT data were only provided for students with parental consent and, therefore, the non-research sample for PPVT comparisons only consisted of 59 students (i.e., students for whom consent was provided, but were excluded from the research sample due to missing data). Due to the small number of students in this comparison group, we do not have enough information to conclude that

there was a difference between the research sample and the non-research sample in terms of PPVT scores. No significant differences were identified between the research sample and the non-research sample on any other variables. It was not possible to compare the present research sample with children who were screened but ineligible for the program or whose caregivers declined acceptance into the program, because data for these children were unavailable.

Measures

The measures used in the present study can be divided into two categories: screening measures and pre-k indicators of functioning. Screening measures were administered by trained early childhood screeners as part of the pre-k eligibility screening process before children were enrolled in pre-k. Data from screening measures serve as independent variables, or predictors, in the present study. Pre-k indicators of functioning were collected within the first three months of pre-k and serve as the dependent variables, or outcome variables, in this study.

Screening Measures

Brigance Early Childhood Screening *(3rd ed.*[Brigance]; Glascoe, 2010*).* The Brigance assesses multiple key domains of early childhood functioning, such as language development, literacy, mathematics, and physical health and development (Glascoe, 2010). The Brigance is administered by a trained screener and usually takes 10-15 minutes to complete. Bright Beginnings uses two different forms of the Brigance based on the child's age (i.e., different versions for 3- and 4-year-olds). The Brigance is sufficiently sensitive, correctly identifying children with delays or difficulty 82% of the time (Glascoe, 2010). The Brigance has also shown strong internal consistency, test-retest

reliability, and inter-rater reliability as well as strong construct validity, concurrent validity, predictive validity, and discriminant validity (Glascoe, 2010). As a result of how Brigance data were entered and managed by the pre-k program, only total scores were available for the present study.

Screener Observations. Developed by the CMS Pre-K Program, the screener observations checklist includes 23 potential developmental concerns that can be noted by the screener based on her observations of the child while administering the Brigance (J. Babb, personal communication, November 14, 2016). Items reflect possible concerns regarding the child's vision (3 items), speech (3 items), hearing (3 items), self-reliance (3 items), emotional functioning (8 items), motor skills (2 items), and health appearance (1 item). The screener observations score is the total number of risk factors checked. Scores can range from 0 to 23, with higher scores indicating greater risk. The full screener observations checklist is provided in Appendix A

Parent Interview. The 8-item parent interview was developed by the CMS Pre-K Program to collect information about parenting behaviors, the home environment, parental mental health, and parents' concerns about their child's development. Trained CMS staff conduct the interview verbally in a private location at the screening site. The interviewer checks a parent interview item if the respondent indicates a risk factor in response to the interviewer's question. For instance, if the parent reports reading to the child less than three times per week, a risk factor is marked for that item. The parent interview score is the sum of risk factors marked by the interviewer. Parent interview scores range from 0 to 8, with higher scores indicating greater risk. See Appendix B for the full Parent Interview.

Parent Survey. Developed by the creators of the Brigance (described above), the pencil-and-paper parent survey is intended to assess the child's social-emotional development. To complete this survey, parents answer sixteen questions about their child's typical behaviors. Questions are divided into four scales: Relationships with adults, relationships with peers, motivation/self-confidence, and prosocial behaviors (Curriculum Associates, n.d.). Screeners score the survey by adding up potential risk factors. Parent survey scores range from 0 to 16, with higher scores meant to indicate greater risk (see Appendix C for the full Parent Survey). Item-level parent survey data were not available for the present effort. As such, it was not possible to evaluate the role of individual items or assess psychometric properties such as Cronbach's alpha reliability.

Pre-K Indicators of Functioning

Devereux Early Childhood Assessment *(DECA) for Preschoolers.* The DECA (LeBuffe & Naglieri, 1999) is a strength-based measure that assesses early childhood social-emotional development, including positive behaviors and resources as well as behavioral concerns. Specifically, subscales assess three protective factors, i.e., initiative, self-regulation, and attachment/relationships, and the measure also provides a cumulative total protective factors score (based on the 3 protective factor subscales) and a behavior concerns score. Teachers rate the frequency of the DECA's 37 items on a 5-point scale, ranging from zero (never) to four (very frequently). In general, studies have shown that the DECA has sufficient reliability ($\alpha > .93$ for each scale) and validity (Barbu, Levine-Donnerstein, Marx, & Yaden, 2013; Bulotsky-Shearer, Fernandez, & Rainelli, 2013; Lien & Carlson, 2009; LeBuffe & Shapiro, 2004). Although some studies have raised

questions about the discriminant validity of the three protective factors (e.g., Barbu et al., 2013), and some researchers recommend dividing the behavior concerns subscale to reflect internalizing behavior and externalizing behavior (Bulotsky-Shearer, Fernandez, & Rainelli, 2013), LeBuffe and Shapiro (2004) found that the DECA total protective factors scale and behavior concerns scale discriminated between youth with high and low emotional and behavioral challenges. The DECA is an appropriate outcome variable in the present effort because the total protective factors scale and the behavior concerns scale are the only two DECA subscales being used. Possible DECA TPF scores and DECA BC scores were on a *t*-score metric ranging from 28 to 72, with a mean of 50 and *SD* of 10.

Peabody Picture Vocabulary Test *(PPVT – 4th edition).* The PPVT (Dunn & Dunn, 2007) is a widely-used assessment of receptive vocabulary for which children are asked to point to pictures that correspond to spoken nouns, verbs, or adjectives. The PPVT is administered by trained CMS teachers and support staff (not the child's teacher of record) at the beginning and end of the school year. The measure is often used to provide an estimate of scholastic aptitude, with some researchers suggesting that the PPVT measures educational development (i.e., learned abilities) rather than inherent abilities or intelligence (D'Amato, Gray, & Dean, 1988). The PPVT has also shown adequate validity and reliability (Bracken & Prasse, 1983; D'Amato et al., 1988). PPVT scores can range from 20 to 160, with a national mean of 100 and standard deviation of 15 (Dunn & Dunn, 2007).

Procedure

Screening Process. When parents and children arrive at the CMS Pre-K screening office, they sign in and provide demographic information including address, race/ethnicity, and income. After that, a trained CMS screener conducts the parent interview, using an iPad to mark the parent's responses on an electronic survey in Google Forms. Completing the parent interview orally allows the screener to provide parents with relevant information and resources for their child or family based on their responses. For example, if a parent reports that the child has witnessed domestic violence, the screener can connect the parent with a community organization to support the parent as well as the child. After the parent interview, the screener administers the Brigance to the child in another room. While the Brigance is being administered, the parent completes the parent survey on a paper form. Once both the Brigance and the parent survey are completed, the parent and child can leave, and the screener enters item-level data from the Brigance and the final score from the parent survey into the Google Form on the iPad. As a final step, the screener completes the screener observations checklist. Once submitted, data are stored in Google Sheets where they can be analyzed by CMS staff.

DECA Administration. Electronic DECA surveys were distributed to teachers in Bright Beginnings classrooms via Qualtrics in November 2016. Teachers were asked to complete one DECA assessment for each student who had been in their class for at least four weeks. Teachers also had the chance to add students and complete the DECA for those who may have joined their class after the original rosters were entered into Qualtrics. Teachers were able to take breaks between assessments but were instructed not to stop in the middle of a given student's assessment. Teachers had 12 days to submit

DECAs for their entire class. This process was repeated near the end of the school year in May. The present study will only use the data from the initial administration of the DECA.

PPVT Administration. The PPVT was administered by trained pre-k teachers or CMS support staff at the beginning of the year (October) and at the end of the year (May). Students complete the PPVT with trained pre-k teachers or CMS support staff near the beginning (October) and end of the school year (May). Pre-k teachers switch classes when administering the PPVT so that teachers do not administer the PPVT to their students. The PPVT is administered individually to each student.

Participatory Approach. Bright Beginnings leadership and staff played an active role in this research effort. First, findings indicating the extent to which screening data predicted receptive language skills and social-emotional functioning (i.e., RQ1 1) were shared at meetings focused on the broader partnership between the UNC Charlotte Community Psychology Research Lab and CMS Pre-K. Data-driven recommendations for modifying the screening process and improving the eligibility formula (i.e., RQ 2) were discussed at these meetings, as well as in additional small group meetings with the director of the program and staff members who are highly involved with the screening process. In these meetings, tables, written descriptions, and verbal explanations were used to share findings, facilitate understanding, and stimulate discussion.

The participatory approach described here allowed Bright Beginnings leadership and staff to review potential modifications to their screening process and suggest revisions as they saw fit. The researcher conducted additional analyses and provided further information to address any questions or concerns. Adjustments were made

through an iterative process until pre-k leadership and staff conveyed that the revised screening process as well as the eligibility formula aligned with their needs, their knowledge of the children, and the parameters within which they need to function. While the analyses conducted for this effort provided empirical support to guide modifications to the screening process, pre-k leadership were ultimately responsible for making the final decisions about the process and the weighting. The researcher also worked with pre-k leadership and staff to implement those decisions effectively.

Analytic Approach

Specific analyses were conducted to examine each of the study's guiding questions.

Research Question 1 (RQ1): To what extent do screening data predict receptive language skills (PPVT) and social-emotional functioning (DECA) at the beginning of pre-k?

After conducting preliminary descriptive analyses (i.e., means, standard deviations, correlations, etc.) on the study's key variables, a series of hierarchical multiple regressions assessed the relationship between data collected during the screening process (i.e., demographic information, Brigance, screener observations, parent interview, and parent survey) and the outcome variables (i.e., PPVT scores, DECA total protective factors [DECA TPF], DECA behavior concerns [DECA BC]), collected at the beginning of the school year. The PPVT and DECA reflect selected cognitive/language and social-emotional aspects of school readiness, respectively.

Six hierarchical multiple regressions assessed the extent to which each screening scale or screening item predicted language skills and social-emotional functioning at the

beginning of pre-k. The first regression predicted PPVT scores and included demographic information in step 1, Brigance scores in step 2, and screening scores (i.e., aggregate scores from the parent survey, parent interview, and screener observations) in step 3. A second hierarchical regression included individual items from the screener observations checklist (seven items) in step 3 and the risk factors from the parent interview (reflecting six items; analyses did not include parent interview data at the item-level, assessing parent concern regarding their child's experiences in a school setting or parental mental health, because responses for these items were not available) in step four. Parent survey scores were included in step 5, to test if these scores increase our ability to account for variance in PPVT scores beyond the effects of the other variables. The third and fourth hierarchical multiple regressions were conducted in a structurally similar way but predicted DECA total protective factors rather than PPVT scores. Two more hierarchical multiple regressions were then run to predict behavior concerns as assessed by the DECA.

These analyses sought to identify the scales and items that are the strongest predictors of school readiness, in terms of verbal development/receptive language, social-emotional protective factors, and behavior concerns. These analyses also provided an estimate of the percentage of variance in the outcome variables (i.e., PPVT, DECA) accounted for by the screening variables included in the model. The information provided by these six regressions informed the recommendations made to improve the screening process.

Research Question 2 (RQ2): How can the Bright Beginnings screening process and eligibility formula be improved, based on the degree to which the screening data predict receptive language skills and social-emotional functioning at the beginning of pre-k?

Based on the regressions run to address the first research question, as well as a review of research on early childhood education, recommendations regarding how certain scales or items could be altered, removed, or replaced with better predictors of school readiness were made to inform the screening process. Potential improvements to the Bright Beginnings screening process, as well as revisions to the Bright Beginnings eligibility formula (discussed below) thereby incorporated data-guided and participatory approaches. This multi-dimensional research approach allowed for this study's empirical findings to be supplemented by the expertise of Bright Beginnings leadership to increase utility when the program implements the modifications.

To improve the Bright Beginnings eligibility formula, hierarchical regressions were used to predict an aggregate school readiness variable. This school readiness variable was calculated by first standardizing students' scores on the PPVT, the DECA TPF scale, and the DECA BC scale by converting them to *z*-scores. Next, these *z*-scores were weighted and summed, such that the school readiness variable was based on the following proportions, determined in collaboration with Bright Beginnings leadership: 50% PPVT scores, 25% DECA total protective factors, and 25% DECA behavior concerns. Scales were coded such that lower scores indicate lower school readiness. For instance, students who are low in verbal ability or high in behavior concerns would be expected to have a low school readiness score.

Hierarchical multiple regressions were then run to analyze the extent to which screening scales and screening items predicted this proxy for school readiness. Significant coefficients were included in the modified eligibility formula; that is, if the variable was shown to have a significant effect on school readiness, the regression coefficient for that variable was included in the revised formula. For example, if the regression revealed a statistically significant regression coefficient of 2.0 for "self-reliance," a child's school readiness score would decrease by two points for every self-reliance risk factor checked by the screener. Variables with nonsignificant coefficients were discussed with Bright Beginnings staff to determine whether those variables should be excluded from the formula or if their weights should be estimated based on staff expertise. The revised formula was then used to calculate school readiness scores for a list of students provided by Bright Beginnings.

School readiness scores computed using the revised formula were compared to eligibility scores determined by the original formula (i.e., that used by the Bright Beginnings administration) to assess which formula rank-ordered students with greater accuracy (based on their knowledge of those children and their functioning). Variable weights were adjusted through an iterative process in order to narrow in on a formula that predicts school readiness in accordance with program expectations.

CHAPTER 3: RESULTS

Research Question 1: To what extent do screening data predict receptive language skills (PPVT) and social-emotional functioning (DECA) at the beginning of pre-k?

Tables 1 - 3 provide descriptive statistics for all study variables. Table 1 provides this information for the screening measures and shows that children accepted into Bright Beginnings tend to be close to or below the cutoff scores for detecting children with academic or developmental delay, suggesting that many Bright Beginnings students are likely to have such delays (Curriculum Associates, n.d.). Table 2 presents descriptive statistics for the available item-level information from the parent interview and screener observations checklist. These results suggest that parents reported high screen time and a low frequency of reading to their children more often than other risk factors. Table 2 also suggests that screeners more frequently identified risk factors related to speech, emotional functioning, and self-reliance, compared to auditory, vision, motor skills, or physical appearance concerns.

Descriptive statistics for the pre-k indicators of functioning (Table 3) suggest that children in the research sample were substantially below national norms in receptive vocabulary, as measured by the PPVT – the average PPVT score in the research sample at the beginning of pre-k was over one standard deviation below the national norm of 100. Children also tended to be slightly below the national norm of 50 on the DECA TPF scale. Notably, average DECA BC scores in the research sample were also slightly below the national norm of 50.

Table 4 displays the correlations between each screening data point (i.e., scale scores and item scores) and the pre-k indicators of functioning collected in the fall of pre-

k. As anticipated, Brigance scores had a strong positive relationship with PPVT scores, suggesting that students who scored more highly on the Brigance also scored more highly on the PPVT at the beginning of pre-k. Students who scored more highly on the Brigance also tended to have higher DECA total protective factors (TPF) scores and lower levels of teacher-reported DECA behavior concerns. Table 4 also suggests that the scores on the screener observations checklist evidence stronger associations with the DECA's social-emotional indicators of functioning than the PPVT; they showed a moderate negative relationship with DECA TPF and a moderate positive relationship with DECA BC. In other words, as the number of risk factors identified on the screener observation checklist increased, teachers reported fewer social-emotional strengths (DECA TPF) and more behavior concerns (DECA BC) for the child.

Correlational analyses involving specific items from the screening measures (also on Table 4) generally showed minimal to small relationships with the PPVT and DECA scores. For example, multiple parent interview items evidenced associations with these outcome indicators, most often the PPVT. For instance, a lack of reading to the child had a moderate, negative association with PPVT scores, suggesting that children who are read to less show weaker receptive vocabulary. Similarly, when parents reported that they did not have anyone helping them care for their child (i.e., a lack of social support), children scored lower on the PPVT. Parental concerns about development also showed weak relationships with social-emotional functioning, such that teachers tended to rate children as having lower levels of total protective factors (i.e., TPF scores) and higher BC scores when parents had reported more concerns about their child's development at the time of screening.

Several of the items from the screener observations checklist also related to the pre-k indicators of functioning. For instance, screener reported concerns related to self-reliance and emotional functioning showed small, negative relationships with PPVT scores, such that children for whom screeners reported concerns in these areas tended to obtain lower PPVT scores. Across multiple areas, screener-rated concerns were associated with teachers' ratings of children's social-emotional functioning in pre-k. Screeners' concerns about the child's emotional functioning showed the strongest relationships with DECA TPF and BC scores (r = -.27 and .26, respectively). In addition, screener-rated concerns regarding speech, self-reliance, and motor skills also showed small relationships to DECA TPF and DECA BC scores, indicating that students were later rated as having fewer social-emotional strengths and more behavior concerns when screeners identified risk factors in these areas. Across the parent interview and screener observations, while the correlations are generally small, they suggest that screener and parental reports can provide useful data about the risks and challenges children may face and that these reports can help predict subsequent ratings of social-emotional development.

Predicting Receptive Vocabulary as Measured by the PPVT

Two hierarchical multiple regressions were run to assess the extent to which screening scales and screening items predict PPVT scores above and beyond the effects of demographic variables (i.e., race/ethnicity, gender, and per person income). Table 5 shows the results of the first hierarchical multiple regression, which predicted PPVT scores with screening scale scores. Entering only the demographic information resulted in a model that explained 23% of the variance in PPVT scores. This unexpected effect could

be due to the percentage of children in the program who do not speak English in their homes. As anticipated, Brigance scores were the strongest predictors of PPVT scores after accounting for demographic information. Including Brigance scores in the model accounted for an additional 12% of the variance in PPVT scores, above and beyond the effects of the demographic characteristics.

Including composite scores from the other three screening scales only minimally impacted the predictive sensitivity of the model. Although results indicate that the addition of these measures led to significant change in the variance accounted for by the model, this significant finding reflects the increased power for these analyses as a result of the study's large sample size; the step only contributed an additional 1% of the variance to the prediction of PPVT scores, which is not practically meaningful. The screener observations composite was the only scale score that had a significant regression coefficient in the anticipated direction, suggesting that when screeners identified more risk factors on the screener observations checklist, students showed weaker receptive vocabulary. The regression coefficient for the parent interview score was significant in an unanticipated direction, suggesting that PPVT scores would increase as parents indicated more risk factors. The coefficient for the parent survey was non-significant, which is not unexpected, given that the scale was designed to measure social-emotional functioning rather than cognitive or academic abilities.

Table 6 summarizes the results from the second hierarchical multiple regression predicting PPVT scores. The first two steps replicate the prior regression analyses (i.e., Table 5), with the remaining steps assessing the item-level effects of the screener observation and parent interview measures. The results of steps one and two include

some slight differences relative to the findings displayed in Table 5, likely due to missing item-level data and the subsequent minor changes to the sample. Beyond that, similar to the previous regression, including screener observations items in step 3, and parent interview items in step four, only slightly improved the model's ability to account for variance in PPVT scores, as evidenced by an R^2 change of .01 and .02 for steps three and four, respectively. None of the screener observations items showed significant relationships with PPVT scores, and while screen time, reading to the child, and parental concerns about development did have significant coefficients, these relationships resulted in little unique contribution to the overall model. Including parent survey scores in step five had no effect – its inclusion did not account for any additional variance in PPVT scores.

Table 7 shows the regression weights for all variables in the model after step 5. As shown in the table, none of the screener observations items had significant effects on PPVT scores, although the associations present are in the anticipated direction (i.e., increased risk relating to lower PPVT scores). Screener-rated concerns about emotional functioning and motor skills were the only items that approached significance in the expected direction; screener-rated physical health appearance also approached statistical significance, but the positive coefficient suggests that screener concerns about the child's physical health appearance would actually be associated with an increase in PPVT scores. This unexpected finding is likely due to the uncommon endorsement of this item.

The only item on the parent interview with a significant coefficient in the anticipated direction was "reading to the child," which indicated whether parents read to the child at least four times per week. The significant unstandardized regression

coefficient for this item, the only language-focused item on the parent interview scale, suggests that children whose parents did not read to them at least 4 times per week would be expected to score 2.4 points lower on the PPVT when all other variables are held constant. Screen time and parental concerns about development had significant positive effects on PPVT scores, such that greater screen time and more parental concerns about development suggested higher PPVT scores. These findings were unexpected given the use of these items as risk factors, but may be explained by the type of screen time or the nature of parental concerns.

Overall, the best predictors of receptive vocabulary at the beginning of pre-k were Brigance scores, reading to the child (at least 4 times per week), screener-rated emotional functioning, and screener-rated motor skills. Race/ethnicity also had a large effect on PPVT scores, such that white, black, and multiracial children appear to do significantly better (by an average of 10-12 points) than Hispanic children on the PPVT.

Predicting Social-Emotional Functioning: DECA Total Protective Factors

Two hierarchical multiple regressions were run to assess the extent to which screening scales and screening items predict DECA TPF scores above and beyond the effects of demographic variables (i.e., race/ethnicity, gender, and per person income). Table 8 shows the results of the first hierarchical multiple regression, which assessed the extent to which screening scale scores predicted teacher-rated TPF scores. The low *Adjusted* R^2 for step 1 suggests that the demographic variables had a much smaller effect on social-emotional functioning than they did on language skills, accounting for just 4% of the variance in TPF scores. Although none of the race/ethnicity coefficients were significant, gender did seem to have a moderate effect on students' TPF scores,

suggesting that girls are predicted to have DECA TPF scores that are 3.76 points higher (i.e., stronger social-emotional functioning) than boys, when race/ethnicity and per person income are held constant.

Including Brigance scores in step 2 significantly increased the degree to which the model could account for variance in DECA TPF scores, although considerably less than the change seen in the model predicting PPVT scores. The regression coefficient for Brigance scores suggests that, as children's Brigance scores increase, their DECA TPF scores (i.e., positive social-emotional functioning) would also increase. Given that the Brigance is largely a measure of cognitive development, it is notable that these scores related significantly to this social-emotional indicator. Including the other three screening scales in step 3 of the model significantly improved predictions of DECA TPF scores ($\Delta R^2 = .05$, $p < .05$). This change seems to be driven by the effect of screener observations scores, suggesting that children who presented more risk factors during the screening process demonstrate fewer social-emotional strengths at the beginning of pre-k and, therefore, were rated lower on the DECA TPF scale. Parent interview scores had a significant but weak negative effect on DECA TPF scores, suggesting that when parents indicated more risk factors in the parent interview, children showed lower levels of social-emotional competencies.

Table 9 shows the results of the hierarchical multiple regression including screening item scores to predict DECA TPF scores. Similar to the analysis with scale scores, screener observations seemed to have a larger effect than the parent interview or the parent survey, after accounting for demographic variables and Brigance scores. Including screener observation items in step 3 explained an additional 6% of the variance

in DECA TPF scores. Including parent interview items in step 4, and the parent survey scale score in step 5, did not improve the model's ability to account for variance in DECA TPF scores.

Table 10 shows the regression coefficients for all variables in step 5 of the second hierarchical regression. Examining the standardized regression coefficients in this final model suggests that screener-rated emotional functioning was the strongest predictor of DECA TPF scores. That is, children who present with more emotional functioning concerns during the screening process were more likely to be rated by their teachers as having fewer social-emotional strengths. Screener-rated motor skills also had a significant effect on DECA TPF scores, such that children for whom screeners marked concerns about motor skills were more likely to be rated with fewer social-emotional strengths during the fall of their pre-k year. Brigance scores and gender were the only other significant predictors in the final model. Girls and children with higher Brigance scores were predicted to show stronger social-emotional functioning as measured by the DECA TPF scale.

Predicting Social-Emotional Functioning: DECA Behavior Concerns

As with the other indicators of pre-k functioning, two hierarchical multiple regressions were run to assess the extent to which the screening scales and screening items predicted DECA BC scores. Table 11 shows the results of the first, entering screening scale scores to predict DECA BC scores. In step 1, demographic variables accounted for 5% of the variance in DECA BC scores, which may be attributed to gender differences (i.e., girls showing less behavior concerns than boys) and differences associated with race/ethnicity (i.e., Hispanic students [the reference group] showing

fewer behavior concerns than white students). Including students' Brigance scores in step 2 accounted for an additional 2% of the variance in DECA BC scores, a small, but statistically significant improvement.

Including the screening scales in step 3 of the model accounted for an additional 5% of the variance in BC, above and beyond the effects of demographic variables and Brigance scores. Similar to the hierarchical regressions predicting DECA TPF scores, scores on the screener observations checklist showed the strongest relationship with DECA BC scores. The screener observations checklist was the only scale that had a significant effect on DECA BC scores (although the parent survey approached significance). The regression coefficients for all three screening scales suggested that teachers rated children as having more behavior concerns when more risk factors were noted during the screening process. Overall, the final model (including all 3 steps) explained 12% of the variance in DECA BC scores.

Table 12 shows the results of a hierarchical regression predicting DECA BC scores, but including screening items from the screener observations checklist and the parent interview instead of scale scores for these measures. Including screener observations items in step 3 explained an additional 6% of the variance in DECA BC scores, above and beyond the effects of demographic variables and Brigance scores. Parent interview items explained an additional 1% of the variance in step 4 and parent survey scores added less than 1% in step 5.

Table 13 shows the regression coefficients for all variables in the final model of the hierarchical multiple regression using screening items to predict DECA BC scores. Similar to the model predicting DECA TPF scores, screener-rated emotional functioning

was the strongest predictor of DECA BC scores. The regression coefficient for emotional functioning concerns suggested that students about whom screeners had more concerns about their emotional functioning showed more behavior concerns at the beginning of pre-k. The regression coefficients for screener-rated motor skills and speech were also significant, such that concern in these areas was associated with more behavior concerns in pre-k. On the parent interview, the regression coefficient for parental concerns about development was significant, such that more parental concerns were associated with more behavior concerns. Gender also was significant in this model, with results suggesting that teachers rated boys as having more behavior concerns than girls in pre-k. The regression coefficient for Brigance scores approached statistical significance and indicated that behavior concerns decreased slightly as Brigance scores increased.

Research Question #2: How can the Bright Beginnings screening process and eligibility formula be improved, based on the degree to which the screening data predict receptive language skills and social-emotional functioning at the beginning of pre-k?

Improving the Screening Process: Data Collection and Management

The analyses conducted for the first research question informed multiple suggestions for improving the screening process. The finding that the parent survey did not explain any additional variance in PPVT scores, DECA TPF scores, or DECA BC scores, above and beyond Brigance scores and other screening items supported a recommendation to replace the parent survey with a different measure to collect social-emotional information about the students from their parents. The rationale for this recommendation was reinforced by the nonsignificant parent survey regression

coefficients in the models predicting PPVT and DECA TPF scores. Moreover, although this variable's coefficient approached significance in predicting DECA BC scores, including this variable did not increase the amount of variance accounted for in DECA BC scores. These findings support the preexisting concerns of Bright Beginnings leadership that the information provided by the parent survey was not meaningfully increasing their understanding of students' needs.

Based on this recommendation, Bright Beginnings and the UNC Charlotte Community Psychology Research Lab (CPRL) worked together to identify other possible measures of early childhood social-emotional development that could improve the screening process. After considering multiple measures and evaluating their assets and limitations, including practical factors, the group consensus was to use the Strengths and Difficulties Questionnaire (SDQ; Stone, Otten, Engels, Vermulst, & Janssens, 2010). On the SDQ, parents rate the degree to which 25 items describe their children's behavior (i.e., Not True, Somewhat True, Certainly True). The measure yields composite scores for emotional problems, conduct problems, hyperactivity, and peer problems, which can be summed to provide a composite social-emotional difficulties scale. The SDQ also provides a composite score for prosocial behaviors. We selected the SDQ because it provides information on multiple dimensions of social-emotional development and functioning, which can be used for determining eligibility for Bright Beginnings as well as informing placement decisions and providing teachers with background information about their students before the school year begins. Of salience, this measure yields this information without being long or burdensome for the parent to complete.

A second recommendation was to collect data on continuous scales instead of dichotomous scales when possible. As one example, in response to the screening item about how often they read to their children, parents' answers can range from zero to seven nights per week. However, in the past, instead of entering the exact number provided, screeners only entered whether they read to their children at least four nights per week or less than four nights per week. Collecting data on a continuous scale for this item and other similar items would increase item variability and potentially increase the predictive sensitivity of each item. By making the changes recommended here, we hope to collect data that improve our ability to understand the strengths and needs of Bright Beginnings applicants and collect data in a way that allows for further research and additional improvements in the future.

Improving the Eligibility Formula

In order to enhance the eligibility formula, a necessary preliminary step entailed the calculation of a composite, school readiness score for each child. For the present purposes, children's scores from the fall of the pre-k year were used. Specifically, to calculate a school readiness variable, each child's PPVT scores, DECA TPF scores, and DECA BC scores were converted to standardized z-scores. Next, the z-scores were weighted and summed based on the formula below to compose a school readiness variable comprised of 50% PPVT scores, 25% DECA TPF scores, and 25% DECA BC scores. These weightings were chosen because Bright Beginnings leadership sought eligibility scores that reflected 50% language abilities and 50% social-emotional functioning. On the resulting scale, students with stronger receptive vocabulary, more social-emotional strengths, and fewer behavior concerns would have higher scores.

Challenges in any of these areas would result in a lower score. A constant of 56 was added to the school readiness outcome variable so that the resulting formula would produce school readiness scores that were positive numbers, increasing their interpretability.

School Readiness = (10 x PPVT-Z) + (5 x DECA TPF-Z) - (5 x DECA BC-Z) + 56

Table 14 shows the mean and standard deviation for the school readiness variable after a constant of 56 was added to each child's score. Higher scores on this scale would represent high school readiness (i.e., low risk) meaning a child with a higher score would be more prepared to begin kindergarten. Hierarchical multiple regressions were run to assess the extent to which screening scales and screening items predicted school readiness scores. The goals of these analyses were to 1) assess the amount of variance in school readiness accounted for by each screening scale or set of items, and 2) contribute to data-guided decisions about the weights given to each screening scale or screening item in a revised eligibility formula.

Table 15 shows the results of the first hierarchical multiple regression, which included Brigance scores in step 1, screener observations scores in step 2, parent interview scores in step 3, and parent survey scores in step 4. Scales were entered in this order based on the correlations between each screening scale and each indicator of functioning in pre-k. That is, scales that were stronger predictors of the pre-k indicators (i.e., Brigance, screener observations) were entered before those that did not relate to pre-k functioning as strongly (i.e., parent survey). Demographic variables were not included in these analyses because gender, race/ethnicity, and per person income cannot be used to determine eligibility for Bright Beginnings.

As shown in Table 15, the Brigance alone accounted for 17% of the variance in school readiness. The screener observations checklist significantly improved our ability to predict school readiness scores, explaining an additional 2% of the variance in the outcome variable. Including parent interview scores in step 3 and parent survey scores in step 4 did not improve predictions. In the final model (after all steps), the four scale scores accounted for 19% of the variance in school readiness, with only Brigance and screener observations scores contributing significantly to the prediction of the school readiness composite. The standardized regression coefficient for Brigance scores suggests that for every standard deviation increase in Brigance scores (i.e., an increase of 14.9 points), school readiness would be expected to increase by .34 standard deviations, an increase of 5.1 points. The standardized regression coefficient for screener observations scores suggests that for every standard deviation increase in screener observations scores (2.8 more risk factors checked), school readiness would be expected to decrease by .17 standard deviations, a 2.55-point decrease.

A second hierarchical multiple regression assessed the extent to which screening items were able to predict school readiness scores, above and beyond the effect of the Brigance scores. In this hierarchical regression, Brigance scores were entered in step 1, screener observations items were entered in step 2, and parent interview items were entered in step 3. As shown in Table 16, the results of this analysis suggest that, after accounting for the Brigance, screener observations items explained an additional 4% of the variance (i.e., step 2), and parent interview items explained an additional 3% of the variance in school readiness (i.e., step 3). Altogether, when screener observations items and parent interview items were entered, the model accounted for 21% of the variance in

school readiness, 2% more than the model that included composite scale scores only. This finding suggests that using the screening items may result in better predictions of school readiness than relying on the composite scores for each scale.

Table 17 shows the regression coefficients for each variable in the final step (i.e., step 3) of the regression model predicting school readiness. Brigance scores, screener-rated emotional functioning, screener-rated motor skills, and parent-reported frequency of reading to the child are shown to be the best predictors of school readiness and were the only variables with significant regression coefficients in the anticipated direction. This finding is not unexpected – these variables tended to have the largest effect sizes when predicting receptive vocabulary and social-emotional functioning in the other three sets of regressions.

However, screener-rated physical health appearance, parent-reported screen time, parental concerns about development, and exposure to domestic violence seemed to have relationships with school readiness that were opposite to what would be expected. The model suggests that school readiness would be predicted to increase as risk in these areas increases (i.e., unhealthy physical appearance, more screen time, more concerns about development, or exposure to domestic violence); however, it is important to underscore that the coefficient for screen time was the only one to reach statistical significance. These findings may reflect low variability or low endorsement of negative physical appearance and exposure to domestic violence. Positive coefficients for screen time and concerns about development may be related to the nature of these items.

In light of the counter-intuitive regression coefficients for these variables (and possible explanations for the observed effects), they would not be used for weighting the

final eligibility formula. As a next step, an additional hierarchical regression was run using the screening items to predict school readiness but excluding the 4 counter-intuitive variables. Table 18 shows the results of this analysis, which included Brigance scores in step 1, screener observation items (excluding "physical appearance") in step 2, and parent interview items (excluding screen time, parental concerns, and domestic violence exposure) in step 3. This model explained 20% of the variance in school readiness.

The emerging regression formula for predicting school readiness is shown below. The unstandardized coefficients for each variable show the expected change in school readiness per unit change in that variable, when all other variables are held constant. The formula below provided a data-driven starting point for developing the revised formula for determining eligibility for Bright Beginnings. It is important to note that the coefficient for parent-child activities was reduced to 3 (from 8.91) because of the wide confidence interval for that item. By utilizing a more conservative estimate, we can ensure that lack of parent-child activities, as assessed in the parent interview does not have an excessive effect on eligibility this year.

School Readiness (Eligibility Score) = 45.77 + .31*Brig. – 2.97*Aud. - .64*Vision - .27*Speech - .71*SR – 1.75*EF – 4.25*MS – 3.61*Reading – .94*SS – 3*P-CActivities

Revising the School Readiness Formula through a Participatory Process

The formula shown above was shared with Bright Beginnings leadership for their review during one of the large group meetings of the management team that focuses on the broader partnership between UNC Charlotte's CPRL and CMS Pre-K. After explaining the formula and how it could be used, Bright Beginnings leaders were asked the following questions:

1. Do the weightings provided for each item seem appropriate?
2. Should items with counter-intuitive regression coefficients be included in the final formula and, if so, how should those items be weighted?
3. How should additional scales (i.e., scales that were not used at the time of data collection and, therefore, do not have data-driven weights), such as the SDQ, be figured into the formula?

In this first discussion, Bright Beginnings leaders generally seemed to approve of the weights allocated to the screening items included in the formula but asked for more information. As one case in point, they expressed surprise that motor skills had such a large impact on language and social development and expressed concern about weighting motor skills so strongly. Bright Beginnings administrators also asked to use Brigance scores that were weighted by age in the eligibility formula. Including age-weighted Brigance scores would reduce the risk of falsely identifying developmental differences (i.e., reflecting variability in chronological age) at the time of screening as cognitive delays. By using weighted Brigance scores in the eligibility formula, we could avoid having a disproportionate rate of younger students (i.e., younger 3-year-olds) being identified as eligible for the program, while older students (i.e., older 3-year-olds) would be at a disadvantage. Program leadership also indicated that screener-rated concerns about physical appearance, parental concerns about development, and exposure to domestic violence should be included in the final formula. However, they were unsure how these items should be weighted and asked to see an example of how the final eligibility formula would work.

To accommodate this request, we decided to demonstrate how the revised eligibility formula would work in relation to the existing formula. Specifically, we sought to illustrate how the revised formula rank-ordered students and allow Bright Beginnings leadership to see the factors that caused certain students to move up the eligibility list, while others moved down. CMS provided a list of 114 children who entered Bright Beginnings in 2017, including some students who had shown fairly high school readiness (i.e., low risk), some who had shown moderate school readiness (i.e., moderate risk), and others who had shown low school readiness (i.e., high risk). The revised formula used for this comparison included estimated weightings for parental concerns about development, exposure to domestic violence, screener-rated physical health appearance, and scores on the Strengths and Difficulties Questionnaire, arrived at through conversations with Bright Beginnings to determine the maximum impact that these variables should have on school readiness. On the basis of the program leaders' responses and suggestions, the coefficient for motor skills in the revised formula was also reduced to 2.0 in order to weight motor skills concerns more conservatively. The constant was also removed from the formula.

Following these modifications, the revised formula shown below was used to calculate the school readiness scores (i.e., eligibility scores) for these 114 students. Students were then rank-ordered based on their scores. This rank-ordered list was provided to Bright Beginnings leadership next to a rank-ordered list of students based on the original formula. An additional column indicated how much each child's rank would change if the new formula was used. A deidentified version of this formula comparison table may be found in Appendix D. Based on their experiences with the students on the list, Bright Beginnings leaders were able to provide additional insight regarding the

extent to which the rank-order changes were appropriate, given the degree to which they were consistent with what they knew about a given student's development and functioning in an absolute sense and relative to the student's peers on the list. They were also able to examine each student's screening profile to see which risk factor(s) caused the student's ranking to change. Comparing the two formulas in this way led Bright Beginnings leadership to tentatively approve the revised formula.

Elig. Score =.31*WeightedBrigance - 2.97*HearingConcerns. - .64*VisionConcerns - .27*SpeechConcerns - .72*SelfRegulation - 1.75*EmotionalFunctioning - 2*MotorSkills - 1*PhysicalHealthAppearance - 3.61*FrequencyofReading - .94*ParentalSocialSupport - 3*ActivitiesWithChild - 1*DevelopmentalConcerns - 5*DomesticViolenceExposure - 1*SchoolConcerns - 1*ParentalMentalHealthConcerns - 20*McKinneyVento - 20*DSS - .18*SDQTotalDifficulties + .18*SDQProsocialBehaviors

To help clarify the effects of the proposed changes, I provided Bright Beginnings leaders with a more detailed explanation of the estimated weights of each independent variable. Table 19 shows the estimated amount of variance that each variable could potentially account for in determining school readiness scores. These percentages were calculated through a three-step process. First, the coefficients for each variable were multiplied by the highest possible score for that variable. For instance, the revised screening process included 2 risk factors for motor skills that could be checked. Therefore, the coefficient for motor skills (2) was multiplied by 2 to calculate the number of points that a student's score could change if both motor skills risk factors were checked. Then, the potential effect of each variable was summed to calculate the total amount of potential variance in the school readiness variable, which was calculated to be

113.23. It is important to note that this sum is not a range of school readiness, but a sum of maximal effects for each variable. Dividing the potential effect of a given variable by this total sum provided the percentages shown in Table 19. For motor skills, 2 times 2, and then divided by 113.23, equals 3.5%.

Table 20 shows the amount that a student's eligibility score would decrease if one or all of the risk factors on a given item were checked. These percentages show the amount that the eligibility score would change on the basis of identified risks for a student who had a high weighted Brigance score, estimated as 150 (a Brigance score that is 50% higher than the norm for children of his or her age, suggesting the child would be prepared to succeed academically in kindergarten). If none of the possible risk factors were marked for this student, this Brigance score would yield an eligibility score of 46.5, which would be fairly high on the distribution of revised eligibility scores, making it less likely that the child would be eligible for Bright Beginnings. The percentages shown in the table were calculated by dividing the coefficient for each item by this relatively high score of 46.5. On the other hand, if a student received a low Brigance score, they would receive a low eligibility score and most likely be eligible for Bright Beginnings, regardless of the number of additional risk factors observed. This procedure was chosen to demonstrate how a student with a high Brigance score (i.e., a student who likely would not have been eligible using the previous formula) could become eligible for Bright Beginnings if certain risk factors were marked.

Tables 19 and 20 demonstrate how Brigance scores and screener-rated emotional functioning are weighted more heavily than the other variables in the formula. Hearing concerns, reading to the child, SDQ scores, exposure to domestic violence and motor

skills could also have significant and independent effects on eligibility. Although hearing concerns and domestic violence exposure could potentially have a significant impact on a child's eligibility, these risk factors were rarely observed in the screenings used for these analyses. McKinney-Vento status (i.e., homelessness) and Department of Social Services (DSS) custody are two other rarely observed risk factors that were incorporated into the formula as 'overrides.' That is, if either of these boxes is checked during the screening process, the student's eligibility score would decrease by over 40%, practically ensuring that they are eligible for Bright Beginnings. Risk factors that fall into the "other" category (e.g., parental social support, auditory concerns, etc.) are shown to have minor effects on the final eligibility score but could potentially reduce eligibility scores substantially if multiple risk factors are observed.

Finally, I provided an interactive Excel workbook that included the revised formula and spaces where Bright Beginnings staff could enter a score for each item assessed during the screening process. This interactive workbook allowed staff to enter different scores and see how eligibility score would increase or decrease depending on a hypothetical student profile (i.e., high Brigance score, multiple risk factors, and low SDQ prosocial behaviors). This demonstrated how item ratings (i.e., risk factors) would interact with different Brigance and SDQ scores to produce high or low eligibility scores.

Based on their review of the materials described here, Bright Beginnings leaders approved the formula shown above. As with the prior formula used by Bright Beginnings, the revised formula weights Brigance scores as the strongest factor when determining eligibility. However, this new version allows for more weight to be placed on other variables, such as screener-rated emotional functioning, frequency of reading to

the child, screener-rated motor skills, and social-emotional functioning, as measured by the SDQ. In addition, the majority of weights provided in this formula are informed by the analyses run in this study. Variables that were not available for the analyses and variables with nonsignificant or counter-intuitive regression coefficients were conservatively estimated based on the expertise of Bright Beginnings leadership.

Bivariate regressions were run to assess the predictive sensitivity of the revised eligibility formula compared to that of the previous formula. To conduct these regressions, one eligibility score was calculated for each student in the sample using the revised eligibility formula, while another eligibility score was calculated using the original eligibility formula. It is important to note that the scores calculated using the revised eligibility formula did not include all components of this new formula. For instance, SDQ scores were not completed for students in the research sample, so those scores could not be included in the eligibility scores. Two bivariate regressions were run to predict each indicator of functioning in pre-k (i.e., PPVT scores, DECA TPF scores, DECA BC scores) as well as students' composite school readiness scores. One bivariate regression for each outcome included revised eligibility scores as the predictor variable, while the other regression included the original eligibility scores. Comparing the *Adjusted* R^2 terms for each regression provides an estimate of the variance in the outcome variables accounted for by each eligibility score.

Table 21 shows the *Adjusted* R^2 terms for each bivariate regression. As shown in the table, the revised eligibility scores accounted for more variance in each of the indicators of pre-k functioning. While the revised scores only accounted for slightly more variability than the original scores when predicting PPVT scores, scores based on the

revised formula explained substantially more variance in social-emotional outcomes. This finding fits with our expectations because the original formula relied more heavily on Brigance scores, which were the best predictors of receptive vocabulary (i.e., PPVT scores) at the beginning of pre-k. The revised formula emphasizes social-emotional measures more than the prior eligibility formula and explains more of the variance in DECA TPF scores and DECA BC scores as expected. Most notably, the revised formula accounted for 4% more variance in composite school readiness scores, despite the fact that all components of the revised formula could not be taken into account when calculating revised eligibility scores. Taken together, these findings suggest that the revised eligibility scores are better predictors of functioning in pre-k than the original eligibility scores. Therefore, it would be more appropriate to use the revised eligibility formula rather than the original eligibility formula to estimate school readiness before pre-school and determine eligibility for Bright Beginnings.

CHAPTER 4: DISCUSSION

The goals of this study were to 1) better understand the relationship between the early childhood screening variables collected by CMS and children's school readiness at the beginning of pre-k, and 2) provide data-driven suggestions to improve the Bright Beginnings screening process and eligibility formula. Through a series of hierarchical regressions, this study sought to evaluate the predictive sensitivity of screening scales and items used by the CMS Pre-K Program, while also showing how the risk factors collected through the screening process could be used together to predict functioning at the beginning of pre-k and make eligibility decisions. Ultimately, this process was designed to help researchers and practitioners identify children with the greatest need (i.e., low school readiness) and increase the likelihood that those children are accepted into an early childhood education program and prepared for better futures.

The paragraphs that follow will discuss the findings of this study in relation to the study's guiding questions. In doing so, I will provide an explanation for this study's findings and discuss how these results fit with existing literature. I will also share some limitations of this study and explain how this study's findings could influence practice in pre-k screening, in CMS schools as well as other school districts. Finally, I will discuss future directions for research that grow out of this study.

In regard to early childhood language development, the results of this study suggest that Brigance scores and the frequency at which parents read to their children are the strongest predictors of receptive vocabulary in pre-k. These findings support the predictive validity of the Brigance III as well as the findings of Britto et al. (2006), which

suggested that engaging children in reading activities can improve the development of language skills and, thereby, increase school readiness.

While demographic characteristics cannot be used for determining Bright Beginnings eligibility, some of these variables were active in predicting receptive vocabulary. For instance, per-person income showed a moderate effect, such that students from low-income families tended to show weaker receptive vocabulary. This finding is consistent with existing research connecting low-income status with poor development of language skills in early childhood (Forget-Dubois et al., 2009; Lazarte-Alacla, Salehezadeh, & Schumacher, 2013). Race/ethnicity strongly predicted receptive vocabulary as well, which likely reflects the difficulties of developing English language skills for students living in non-English speaking households.

In the present study, screener-rated emotional functioning and motor skills were the best predictors of social-emotional functioning at the beginning of pre-k. The effect of emotional functioning at the time of screening suggests that the pre-k program's trained screeners are accurately identifying emotional concerns during the screening process that relate to the social-emotional concerns observed by pre-k teachers. The effect of screener-rated motor skills may suggest that delayed development of motor skills is related to inhibited social-emotional development as well. Brigance scores were also found to be significant predictors of social-emotional strengths as measured by the DECA TPF scale. These findings may suggest that delays in one domain, such as cognitive development or the development of motor skills, are associated with delays in other developmental domains, such as social-emotional functioning.

Gender was also shown to have a significant effect on social-emotional strengths and behavior concerns, with girls showing more protective factors and fewer behavior concerns than boys. This finding is consistent with existing research showing that boys display more behavior concerns and externalizing behavior than girls at 3-5 years of age (Entwisle, Alexander, & Olson, 2007; Owens, 2016). Multiple potential explanations have been put forth for these observed differences, including gender differences in parental interactions, socialization, teacher perceptions of the child, and even biology (Entwisle et al., 2007; Owens, 2016). Gender and SES may also interact such that low-income boys tend to show (or be rated as showing) more problem behaviors than girls or boys from higher SES families (Entwisle et al., 2007). Regardless of the root causes, lower social-emotional functioning and more problem behaviors for boys in early childhood have been suggested to set boys on more negative educational and developmental trajectories, contributing to a gender gap in educational achievement (Owens, 2016). Although outside the immediate scope of this study, the current findings point to the potential value of an investigation of the degree to which gender differences in social-emotional functioning narrow or widen over the course of pre-k.

Screen time (from the parent interview) yielded a mixed pattern of relationships with receptive vocabulary and social-emotional functioning at the beginning of pre-k. In this study, screen time showed a significant positive effect on receptive vocabulary, but nonsignificant, detrimental effects on social-emotional development, and behavior concerns in particular. While some research suggests that screen time has a detrimental effect on language development (see Byeon & Hong, 2015; Pagani, Fitzpatrick, & Barnett, 2013), the current findings support the idea that screen time may actually

improve language development, especially if it includes educational programs (Anderson & Pempek, 2005). However, the nonsignificant detrimental effects of screen time on behavior concerns support literature connecting screen time with emotional reactivity, aggression, and behavior problems (Chonchaiya et al., 2015; Pagani et al., 2013). These findings have implications for the use of screen time in determining eligibility for pre-k, because screen time may promote language development (and potentially social-emotional development; see Gentile et al., 2009) under certain circumstances, while potentially having a negative effect on behavior and social-emotional development. To address these mixed effects, it may be helpful to ask parents about the amount of time their children spend watching educational programming or interacting with an educational application, as well as more general screen time.

Based on study findings, we recommended that Bright Beginnings replace the parent survey with an alternate measure of social-emotional functioning (i.e., the SDQ) and collect data on continuous scales rather than dichotomous (i.e., risk or no risk) scales. These modifications were designed to increase the utility of data collected by Bright Beginnings, while also allowing for future research involving more precise analyses assessing the effect of each item. After discussing these suggestions, the CPRL worked with Bright Beginnings leadership to implement these changes.

Next, we used hierarchical multiple regressions to assess the predictive sensitivity of screening scales and screening items on a composite school readiness variable. Similar to the previous analyses, these regressions suggested that 1) Brigance scores and screener observations scores were better predictors of school readiness than parent interview scores or parent survey scores; 2) screening items appeared to predict school readiness

better than the scale scores; and 3) screener-rated emotional functioning concerns, motor skills concerns, and the frequency of reading to the child were the strongest item-level predictors of school readiness.

Screener-rated physical health appearance, parental concerns about development and exposure to domestic violence had nonsignificant effects on school readiness in the opposite direction, suggesting that risk in these areas would actually lead to higher school readiness. For physical health appearance and exposure to domestic violence, this result may have occurred due to the low endorsement of risk in these areas. The positive relationship between parental concerns about development and school readiness may suggest that parents with greater concerns are also more involved in their child's development (they are involved enough to know the child may be behind or functioning outside the norm in a particular area, as well as invested enough to report it), leading to improved functioning.

An additional hierarchical regression, excluding items that had counter-intuitive effects on school readiness, provided a starting point for a participatory process to revise the Bright Beginnings eligibility formula. After multiple iterations of edits and discussions, we landed on a final eligibility formula that was entered into the database to automatically provide eligibility scores for newly screened children.

There are multiple data-supported benefits of the revised formula for determining eligibility for Bright Beginnings over the formula employed previously. First, the formula utilizes item scores, or indicators of individual risk factors, to predict student need rather than scale scores. This change is supported by the analyses done for each component of school readiness (i.e., receptive vocabulary, social-emotional protective factors, and

behavior concerns), which demonstrated that the item-level data explained a greater amount of variability in these indicators of student outcomes than the scale scores. Second, the revised formula places greater weight on the individual risk factors (i.e., items) that were stronger predictors of school readiness. Specifically, emotional functioning, motor skills, and frequency of reading to the child are the three commonly endorsed items that are weighted most heavily in the revised formula. While other risk factors such as screener-rated self-reliance and lack of parent-child activities have smaller weightings, they can still influence students' eligibility scores, especially when observed concurrently with other risk factors.

Limitations

There are multiple limitations in the present study. First, the screening data collected through the original screening process dichotomized multiple risk factors, which may have limited our ability to draw conclusions about the relationships among certain risk factors and child functioning at the beginning of pre-k. For example, rather than marking the exact number of days the parent read to their child, screeners would simply enter whether or not this number was above or below a certain threshold. Restriction of range, on this variable, as well as others, may have reduced the estimated effect sizes for those screening variables. Restriction of range also reduces the amount of variability captured by the screening process as a whole. In addition, item-level data was not provided for the Brigance III or the parent survey, which precluded conducting item-level analyses for those scales. Suggestions for improving the quality of data were made by the CPRL and implemented by CMS administrative staff, which will allow for more comprehensive research efforts in the future.

Another limitation is that the research sample for this study was limited to students who were identified as being "at-risk" based on the original eligibility formula and enrolled in Bright Beginnings. The research sample excludes higher-functioning children as well as those who did not enroll in the program even though they were offered admission. Therefore, the sample is not representative of all 3-5-year-old children in Charlotte, and findings may not be generalizable to children functioning at all levels. Furthermore, it is not yet possible to assess the degree to which the eligibility formula developed through this research truly differentiates between low-functioning and high-functioning children because higher-functioning children were largely excluded from the study.

There are also limitations that hindered the development of the revised eligibility formula. One substantive issue was that some of the changes made to the screening process this year were not a part of the original analyses. That is, although the weights for screening variables were based on analyses with range-restricted items, the formula may be applied to risk factors assessed on continuous scales. Additionally, certain screening variables, such as the SDQ, were not included in the original analyses, while other variables, such as screen time and exposure to domestic violence showed counter-intuitive effects on child functioning. To include these variables in the eligibility formula, their weightings were estimated in collaboration with Bright Beginnings leadership. The inclusion of estimated weightings and the changes made to this year's screening process limit the precision of the new eligibility formula. For this reason, improving the eligibility formula should be seen as an incremental process, which involves making certain improvements this year, but conducting additional research in the coming years to

refine the formula further. Next year's iteration can draw on SDQ data, item-level Brigance scores, and more.

Contributions

Notwithstanding these limitations, this study has multiple implications for Bright Beginnings. First, revising the screening process and eligibility formula will help Bright Beginnings continue to collect practical information from parents and children and utilize those data with greater precision to inform decisions. The participatory approach taken in this study addressed feasibility concerns and helped Bright Beginnings implement the suggested changes. In doing so, we were able to minimize any potential burden of implementation that would have been placed on Bright Beginnings staff. Furthermore, the participatory approach allowed us to share our ideas of the resulting products and procedures during implementation and revise as necessary based on their comments and concerns. Additionally, taking a data-driven approach to determining eligibility for Bright Beginnings can help ensure that children with the greatest need for early childhood education are deemed eligible and accepted into the program. Finally, the recommendations provided from this study can support stronger data capacity by helping CMS staff determine which data points should be shared with pre-k teachers and principals at the beginning of the school year. For example, teachers may benefit from knowing how often a child's parents read to them at home or the emotional functioning concerns that the screener identified, especially because these risk factors were shown to predict language skills and social-emotional functioning.

More broadly, this research could have implications for other publicly-funded early childhood programs as well. By improving our understanding of the extent to which

early childhood risk factors predict language skills and social-emotional functioning at the beginning of pre-k, this study provides empirical guidance for weighting certain risk factors (such as emotional functioning and frequency of reading to the child) more highly than others. Other programs may benefit from assessing emotional functioning risk factors as well as the frequency at which parents read to their children, and accounting for those variables when making eligibility determinations. This study also addresses a gap in the literature by not only identifying risk factors that relate to child functioning in pre-k but providing guidance for using multiple risk factors simultaneously to predict functioning at the beginning of pre-k. The methodology outlined in this study could be conducted in other school districts to assess the predictive sensitivity of the screening criteria used to make eligibility decisions. Engaging in a similar process could yield an eligibility formula that weights risk factors according to their impact on child functioning within the context of a particular school district.

Despite the study's limitations, this multi-step research effort contributed to the development of a revised eligibility formula that accounted for more variance in receptive vocabulary, social-emotional strengths, and behavior concerns, as well as a composite school readiness variable, compared to the original formula. Based on these findings, the modifications described here can help add precision to the Bright Beginnings screening process and will allow for follow up studies to enhance the screening process further.

Future Directions

Additional research assessing the predictive sensitivity of early childhood risk factors as collected through the revised screening process could inform additional modifications that enhance our ability to predict early language and social-emotional

skills in pre-k. For example, the weighting of screening variables could be altered after repeating these analyses with more complete data and a new sample of Bright Beginnings students. The research process carried out in this study could also be replicated in other school districts to guide eligibility determinations based on the local context that influences school readiness in each district. Continuing this research in CMS schools as well as other districts could ultimately enhance our ability to identify students with the greatest need (i.e., those with low school readiness) and ensure that those students can benefit from early childhood education.

Furthermore, investigating the effect of variability within specific items such as emotional functioning or self-regulation could help pinpoint the specific risk factors that are associated with lower school readiness. For instance, checking the emotional functioning risk factor suggesting the child "became impatient when presented with a difficult task," may have a stronger or weaker association with social-emotional functioning than the emotional functioning risk factor suggesting the child "required frequent redirection" or "had difficulty cooperating." Understanding the effect of each individual risk factor could guide efforts to enhance the precision of the eligibility formula moving forward.

An additional avenue of research that would be particularly salient to the present study would be to investigate the extent to which screening items predict growth over the course of pre-k. While the present study helps us identify students with the highest level of need, predicting change over the course of the year would help us identify students who would benefit most from high-quality early childhood education. Addressing this question would complement the present study and help inform the decision-making

processes. Investigating how screening variables predict change over the course of pre-k could also help Bright Beginnings staff identify students who would benefit from additional support.

Based on this study's findings, it may be helpful to continue studying the relationship between screen time and school readiness. Specifically, investigating the conditions under which screen time has a positive or negative effect on child functioning may help early childhood programs ask questions that differentiate between positive and negative forms of screen time, and use that information to better understand risk. Another direction for further research would be to assess the effect of pre-k on the gender gap associated with behavior in early childhood education. Investigating how the effect of gender on DECA BC scores changes from the beginning of pre-k to the end of pre-k can shed light on this question. A longitudinal study comparing boys and girls who receive high-quality early childhood to boys and girls in a comparison group would provide more information about the educational gender gap that continues through elementary school and beyond. Continuing these lines of research could improve our ability to identify at-risk children who would benefit from early childhood education and, furthermore, help us understand the lasting benefits of high-quality early childhood education.

Conclusion

This research aimed to establish a school readiness formula that is directed by data, supported by existing literature, and informed by the expertise of Bright Beginnings leadership. Guided by study findings and a participatory research approach, this project informed a revised screening process and developed a more precise eligibility formula that could be implemented immediately. Taking these steps to revise the eligibility

formula and screening process could increase the likelihood that children with the greatest need for early childhood education are identified for and admitted to Bright Beginnings.

References

American Academy of Pediatrics, Committee on Early Childhood and Adoption and Dependent Care (2000). Developmental issues for young children in foster care. *Pediatrics, 106*, 1145-1150.

American Academy of Pediatrics, Council on Communications and Media (2016). Media and young minds. *Pediatrics*, *138*(5), e20162591. doi:10.1542/peds.2016-2591

Anderson, D. R., & Pempek, T. A. (2005). Television and very young children. *American Behavioral Scientist*, *48*, 505-522. doi:10.1177/0002764204271506

Aratani, Y. (2009). *Homeless children and youth causes and consequences.* Columbia University: National Center for Children in Poverty. Retrieved from http://nccp.org/publications/pdf/text_888.pdf

Barbu, O. C., Levine-Donnerstein, D., Marx, R. W., & Yaden, D. B. (2013). Reliability and validity of the Devereux Early Childhood Assessment (DECA) as a function of parent and teacher ratings. *Journal of Psychoeducational Assessment*, *31*, 469–481. doi:10.1177/0734282912467758

Bassok, D. (2010). Do black and Hispanic children benefit more from preschool? Understanding differences in preschool effects across racial groups. *Child Development*, *81*, 1828-845. doi:10.1111/j.1467-8624.2010.01513.x

Bassuk, E. L. (2010). Ending child homelessness in America. *American Journal of Orthopsychiatry, 80,* 496-504. doi:10.1111/j.1939-0025.2010.01052.x

Bick, J., Fox, N., Zeanah, C., & Nelson, C. A. (2017). Early deprivation, atypical brain development, and internalizing symptoms in late childhood. *Neuroscience*, *342*, 140-153. doi:10.1016/j.neuroscience.2015.09.026

Bracken, B. A., & Prasse, D. P. (1983). Concurrent validity of the PPVT-R for "at risk" preschool children. *Psychology in the Schools*, *20*, 13-15. doi:10.1002/1520-6807(198301)20:1<13::AID-PITS2310200104>3.0.CO;2-N

Britto, P. R., Brooks-Gunn, J., & Griffin, T. M. (2006). Maternal reading and teaching patterns: Associations with school readiness in low-income African American families. *Reading Research Quarterly*, *41*, 68-89. doi:10.1598/RRQ.41.1.3

Bronfenbrenner, U. (1979). Contexts of child rearing: Problems and prospects. *American Psychologist*, *34*, 844.

Bucci, M., Marques, S. S., Oh, D., & Harris, N. B. (2016). Toxic stress in children and adolescents. *Advances in Pediatrics, 63,* 403-428.

Bulotsky-Shearer, R. J., Fernandez, V. A., & Rainelli, S. (2013). The validity of the Devereux Early Childhood Assessment for culturally and linguistically diverse Head Start children. *Early Childhood Research Quarterly*, *28*, 794-807. doi:10.1016/j.ecresq.2013.07.009

Byeon, H., & Hong, S. (2015). Relationship between television viewing and language delay in toddlers: Evidence from a Korea national cross-sectional survey. *PLoS ONE*, *10*. doi:10.1371/journal.pone.0120663

Carolan, M. & Connors-Tadros, L. (2015). *Eligibility policy for state pre-k programs: Research on risk factors and approaches to developing state policy* (CEELO Policy Report). New Brunswick, NJ: Center on Enhancing Early Learning Outcomes.

Carta, J. J., Greenwood, C. R., Atwater, J., McConnell, S. R., Goldstein, H., & Kaminski, R. A. (2014). Identifying preschool children for higher tiers of language and early

literacy instruction within a response to intervention framework. *Journal of Early Intervention*, *36*, 281-291. Developmental issues for young children in foster care. *Pediatrics*, *106*, 1145-1150. doi:10.1542/peds.106.5.1145

Charlotte-Mecklenburg Schools Pre-Kindergarten (2016). *Eligibility and placement.* Retrieved from http://www.cms.k12.nc.us/cmsdepartments/ci/pre-kservices/Documents/Eligibility%20and%20Placement%20for%202016%20website.pdf

Chonchaiya, W., Sirachairat, C., Vijakkhana, N., Wilaisakditipakorn, T., & Pruksananonda, C. (2015). Elevated background TV exposure over time increases behavioural scores of 18-month-old toddlers. *Acta Paediatrica*, *104*, 1039-1046. doi:10.1111/apa.13067

Claessens, A., Duncan, G., & Engel, M. (2009). Kindergarten skills and fifth-grade achievement: Evidence from the ECLS-K. *Economics of Education Review*, *28*, 415-427. doi:.org/10.1016/j.econedurev.2008.09.003

Conner, N. W., & Fraser, M. W. (2011). Preschool social–emotional skills training: A controlled pilot test of the Making Choices and Strong Families Programs. *Research on Social Work Practice*, *21*, 699-711. doi:10.1177/1049731511408115

Conti, G., Heckman, J. J., & Pinto, R. (2016). The effects of two influential early childhood interventions on health and healthy behaviour. *The Economic Journal*, *126*, F28-F65. doi:10.1111/ecoj.12420

Curriculum Associates (n.d.). *Brigance Early Childhood Screen III: 3-5 years.* Curriculum Associates. Retrieved from: http://casamples.com/downloads/14296s.pdf

Curriculum Associates (n.d.). *Parent Report: Self-help and social-emotional Scales.* Curriculum Associates. Retrieved from http://www.casamples.com/downloads/BRIGANCE-K1-SHSES_Parent_English.pdf

Daily, S., Welti, K., Forry, N., & Rothenberg, L. (2012). *Maryland early childhood risk and reach assessment* (pp. 1–31). Child Trends. Retrieved from https://www.childtrends.org/wp-content/uploads/2013/05/Maryland-Early-Childhood-Risk-and-Reach-Assessment.pdf

D'Amato, R. C., Gray, J. W., & Dean, R. S. (1988). Construct validity of the PPVT with neuropsychological, intellectual, and achievement measures. *Journal of Clinical Psychology*, *44*, 934-939. doi:10.1002/1097-4679(198811)44:6<934::AID-JCLP2270440614>3.0.CO;2-2

D'Angiulli, A., Siegel, L. S., & Maggi, S. (2004). Literacy instruction, SES, and word-reading achievement in English-language learners and children with English as a first language: A longitudinal study. *Learning Disabilities Research & Practice*, *19*, 202-213. doi:10.1111/j.1540-5826.2004.00106.x

Deming, D. (2009). Early childhood intervention and life-cycle skill development: Evidence from Head Start. *American Economic Journal: Applied Economics, 1*, 111-134. doi:10.1257/app.1.3.111

Domingues-Montanari, S. (2017). Clinical and psychological effects of excessive screen time on children. *Journal of Paediatrics and Child Health*, *53*, 333-338. doi:10.1111/jpc.13462

Downer, J. T., & Pianta, R. C. (2006). Academic and cognitive functioning in first grade: Associations with earlier home and child care predictors and with concurrent home and classroom experiences. *School Psychology Review*, *35*, 11-30.

Duncan, G. J., Dowsett, C. J., Claessens, A., Magnuson, K., Huston, A. C., Klebanov, P., & Japel, C. (2007). School readiness and later achievement. *Developmental Psychology*, *43*, 1428–1446. doi:10.1037/0012-1649.43.6.1428

Duncan, G. J., & Magnuson, K. (2011). The nature and impact of early achievement skills, attention skills, and behavior problems. *Whither Opportunity*, 47-70.

Dunn, D. M., & Dunn, L. M. (2007). *Peabody picture vocabulary test: Manual*. Minneapolis, MN: Pearson.

Eisenberg, N., Valiente, C., & Eggum, N. D. (2010). Self-regulation and school readiness. *Early Education and Development*, *21*, 681-698. doi:10.1080/10409289.2010.497451

Entwisle, D., Alexander, K., & Olson, L. (2007). Early schooling: The handicap of being poor and male. *Sociology of Education*, *80*,114-138. doi:10.1177/003804070708000202

Farmer, T. W., & Farmer, E. M. Z. (2001). Developmental science, systems of care, and prevention of emotional and behavioral problems in youth. *American Journal of Orthopsychiatry*, *71*, 171-181. doi:10.1037/0002-9432.71.2.171

Forget-Dubois, N., Dionne, G., Lemelin, J.-P., Pérusse, D., Tremblay, R. E., & Boivin, M. (2009). Early child language mediates the relation between home environment and school readiness. *Child Development*, *80*, 736–749. doi:10.1111/j.1467-8624.2009.01294.x

Gentile, D. A., Anderson, C. A., Yukawa, S., Ihori, N., Saleem, M., Lim Kam Ming, Sakamoto, A. (2009). The effects of prosocial video games on prosocial behaviors: International evidence from correlational, longitudinal, and experimental studies. *Personality and Social Psychology Bulletin*, *35*, 752-763. doi: 10.1177/0146167209333045

Glascoe, F. P. (2010). *Technical report for the Brigance Screens.* Curriculum Associates, LLC. Retrieved from http://casamples.com/downloads/12225s.pdf

Gormley, W. T. (2008). The effects of Oklahoma's Pre-K Program on Hispanic children. *Social Science Quarterly*, *89*, 916-936.

Gormley W. T., Phillips D. A., Newmark K., Welti, K., & Adelstein S. (2011). Social-emotional effects of early childhood education programs in Tulsa. *Child Development, 82*, 2095-2109. doi:10.1111/j.1467-8624.2011.01648.x

Greenough, W. T., Black, J. E., & Wallace, C. S. (1987). Experience and brain development. *Child Development*, *58*, 539-559. doi:10.2307/1130197

Guralnick, M. J. (2008). Family influences on early development: Integrating the science of normative development, risk and disability, and intervention, in K. McCartney & D. Phillips (Eds.) *Blackwell Handbook of Early Childhood Development* (44-61), Oxford, UK: Blackwell Publishing. doi:10.1002/9780470757703.ch3

Halle, T., Forry, N., Hair, E., Perper, K., Wandner, L., & Wessel, J. (2009). Disparities in early learning and development: Lessons from the Early Childhood Longitudinal Study--Birth Cohort (ECLS-B). *Child Trends*. Retrieved from http://www.childtrends.org.

Heckman, J. J. (2006). Skill formation and the economics of investing in disadvantaged children. *Science*, *312*, 1900-1902. doi:10.1126/science.1128898

Heckman, J., Moon, S. H., Pinto, R., Savelyev, P., & Yavitz, A. (2010). Analyzing social experiments as implemented: A reexamination of the evidence from the High Scope Perry Preschool Program. *Quantitative Economics*, *1*, 1-46.

Heckman, J., Pinto, R., & Savelyev, P. (2013). Understanding the mechanisms through which an influential early childhood program boosted adult outcomes. *The American Economic Review, 103,* 2052-2086. doi:10.1257/aer.103.6.2052

Hirsh-Pasek, K., & Burchinal, M. (2006). Mother and caregiver sensitivity over time: Predicting language and academic outcomes with variable-and person-centered approaches. *Merrill-Palmer Quarterly*, *52*, 449-485.

Institute of Medicine and National Research Council (2012). *From neurons to neighborhoods: An update: Workshop summary.* Washington, DC: The National Academies Press.

Jiang, Y., Granja, M. R., & Koball, H. (2017). *Basic facts about low-income children: Children under 3 years, 2015.* National Center for Children in Poverty. Retrieved from http://www.nccp.org

Jones, D. E., Greenberg, M., & Crowley, M. (2015). Early social-emotional functioning and public health: The relationship between kindergarten social competence and future wellness. *American Journal of Public Health*, *105*, 2283-2290. doi:10.2105/AJPH.2015.302630

LeBuffe, P. A., & Naglieri, J. A. (1999). *The Devereux Early Childhood Assessment.* Lewisville, NC: Kaplan Press Publishing.

LeBuffe, P. A., & Shapiro, V. B. (2004). Lending "strength" to the assessment of preschool social-emotional health. *California School Psychologist*, *9,* 51-61. doi:10.1007/BF03340907

Kaufman, J. S., Ortega, S., Schewe, P. A., & Kracke, K. (2011). Characteristics of young children exposed to violence: The Safe Start Demonstration Project. *Journal of Interpersonal Violence*, *26*, 2042-2072. doi:10.1177/0886260510372942

Kilmer, R. P., Cook, J. R., Crusto, C., Strater, K. P., & Haber, M. G. (2012). Understanding the ecology and development of children and families experiencing homelessness: Implications for practice, supportive services, and policy. *American Journal of Orthopsychiatry, 82,* 389-401. doi: 10.1111/j.1939-0025.2012.01160.x

Kitzmann, K. M., Gaylord, N. K., Holt, A. R., & Kenny, E. D. (2003). Child witnesses to domestic violence: A meta-analytic review. *Journal of Consulting and Clinical Psychology*, *71*, 339-352. doi:10.1037/0022-006X.71.2.339

Lagercrantz, H. (2016). Connecting the brain of the child from synapses to screen-based activity. *Acta Paediatri*ca, *105*, 352–357. doi:10.1111/apa.13298

Lapointe, V. R., Ford, D. L., & Zumbo, B. D. (2007). Examining the relationship between neighborhood environment and school readiness for kindergarten children. *Early Education and Development*, *18*, 473-495. doi:10.1080/10409280701610846

Lazarte Alcala, N., Salehezadeh, Z., & Schumacher, K. (2013). Oklahoma school readiness risk report 2013: Predictors in school readiness. *Practice & Policy Research Quarterly*. Oklahoma City, OK: Oklahoma Department of Human

Services Office of Planning, Research and Statistics (OKDHS-OPRS). Retrieved from https://www.icpsr.umich.edu/icpsrweb/ICPSR/series/666

Levine, J. A., Pollack, H., & Comfort, M. E. (2001). Academic and behavioral outcomes among the children of young mothers. *Journal of Marriage and Family*, *63*, 355-369. doi:10.1111/j.1741-3737.2001.00355.x

Lien, M. T., & Carlson, J. S. (2009). Psychometric properties of the Devereux Early Childhood Assessment in a Head Start sample. *Journal of Psychoeducational Assessment*, *27*, 386-396. doi:10.1177/0734282909331754

Mancilla-Martinez, J., & Lesaux, N. K. (2010). Predictors of reading comprehension for struggling readers: The case of Spanish-speaking language minority learners. *Journal of Educational Psychology*, *102*, 701-711. doi:10.1037/a0019135

Mantzicopoulos, P. (1999). Risk assessment of Head Start children with the Brigance K & 1 Screen: Differential performance by sex, age, and predictive accuracy for early school achievement and special education placement. *Early Childhood Research Quarterly*, *14*, 383-408. doi:10.1016/S0885-2006(99)00019-8

Margolin, G., & Gordis, E. B. (2000). The effects of family and community violence on children. *Annual Review of Psychology*, *51*, 445-479. doi:10.1146/annurev.psych.51.1.445

Margolin, G., & Gordis, E. B. (2004). Children's exposure to violence in the family and community. *Current Directions in Psychological Science*, *13*, 152-155. doi:10.1111/j.0963-7214.2004.00296.x

Martinez, M. A. (1987). Dialogues among children and between children and their mothers. *Child Development*, *58,* 1035-1043. doi:10.2307/1130544

Mashburn, A. J., & Pianta, R. C. (2006). Social relationships and school readiness. *Early Education and Developmen*t, *17*, 151-176. doi:10.1207/s15566935eed1701_7

Masten, A. S., & Cicchetti, D. (2010). Developmental cascades. *Development and Psychopathology*, *22*, 491–495. doi:10.1017/S0954579410000222

McWayne, C., Fantuzzo, J., Cohen, H. L., & Sekino, Y. (2004). A multivariate examination of parent involvement and the social and academic competencies of urban kindergarten children. *Psychology in the Schools*, *41*, 363-377.

Montes, G., Lotyczewski, B. S., Halterman, J. S., & Hightower, A. D. (2012). School readiness among children with behavior problems at entrance into kindergarten: Results from a US national study. *European Journal of Pediatrics*, *171*, 541-548. doi:10.1007/s00431-011-1605-4

Mulvaney, M. K., McCartney, K., Bub, K. L., & Marshall, N. L. (2006). Determinants of dyadic scaffolding and cognitive outcomes in first graders. *Parenting: Science and Practice*, *6*, 297-320.

Murphy, J. (2011). Homeless children and youth at risk: The educational impact of displacement. *Journal of Education for Students Placed at Risk* (JESPAR), *16*, 38–55. doi:10.1080/10824669.2011.554143

Nakamoto, J., Lindsey, K. A., & Manis, F. R. (2008). A cross-linguistic investigation of English language learners' reading comprehension in English and Spanish. *Scientific Studies of Reading*, *12*, 351-371.

National Center for Children in Poverty (n.d.). *Child poverty.* Retrieved from http://www.nccp.org

Neitzel, C., & Stright, A. D. (2003). Mothers' scaffolding of children's problem solving: establishing a foundation of academic self-regulatory competence. *Journal of Family Psychology*, *17*, 147.

Nelson, K. E., Welsh, J. A., Trup, E. M. V., & Greenberg, M. T. (2011). Language delays of impoverished preschool children in relation to early academic and emotion recognition skills. *First Language*, *31*, 164-194. doi:10.1177/0142723710391887

Okagaki, L., & Frensch, P. A. (1994). Effects of video game playing on measures of spatial performance: Gender effects in late adolescence. *Journal of Applied Developmental Psychology*, *15*, 33–58. doi:10.1016/0193-3973(94)90005-1

Osofsky, J. D. (2003). Prevalence of children's exposure to domestic violence and child maltreatment: Implications for prevention and intervention. *Clinical Child and Family Psychology Review*, *6*, 161–170. doi:10.1023/A:1024958332093

Owens, J. (2016). Early childhood behavior problems and the gender gap in educational attainment in the United States. *Sociology of Education*, *89, 236-238*. doi:10.1177/0038040716650926

Pagani, L. S., Fitzpatrick, C., & Barnett, T. A. (2013). Early childhood television viewing and kindergarten entry readiness. *Pediatric Research*, *74*, 350-355. doi:10.1038/pr.2013.105

Pears, K. C., Healey, C. V., Fisher, P. A., Braun, D., Gill, C., Conte, H. M., & Ticer, S. (2014). Immediate effects of a program to promote school readiness in low-income children: Results of a pilot study. *Education and Treatment of Children*, *37*, 431-460. doi:10.1353/etc.2014.0021

Puma, M., Bell, S., Cook, R., Heid, C., & Lopez, M. (2005). Head Start impact study: First year findings: Executive summary. *Administration for Children & Families*. Retrieved from https://eric.ed.gov/?id=ED543009

Rigterink, T., Fainsilber Katz, L., & Hessler, D. (2010). Domestic violence and longitudinal associations with children's physiological regulation abilities. *Journal of Interpersonal Violence*, *25*, 1669-1683.

Ryan-Krause, P., Meadows-Oliver, M., Sadler, L., & Swartz, M. K. (2009). Developmental status of children of teen mothers: Contrasting objective assessments with maternal reports. *Journal of Pediatric Health Care*, *23*, 303-309. doi:10.1016/j.pedhc.2008.09.001

Scarborough, H. S., & Dobrich, W. (1994). On the efficacy of reading to preschoolers. *Developmental Review*, *14*, 245-302. doi:10.1006/drev.1994.1010

Sheridan, S. M., Knoche, L. L., Edwards, C. P., Bovaird, J. A., & Kupzyk, K. A. (2010). Parent engagement and school readiness: Effects of the Getting Ready intervention on preschool children's social-emotional competencies. *Early Education and Development*, *21*, 125-156. doi:10.1080/10409280902783517

Shonkoff, J. P., Phillips, D. A., National Research Council (U.S.), & Committee on Integrating the Science of Early Childhood Development. (2000). *From neurons to neighborhoods: The science of early child development*. Washington, DC: National Academy Press.

Sripada, K. (2012). Neuroscience in the capital: Linking brain research and federal early childhood programs and policies. *Early Education and Development*, *23*, 120-130. doi:10.1080/10409289.2012.617288

Stone, L. L., Otten, R., Engels, R. C., Vermulst, A. A ., & Janssens, J. M. (2010). Psychometric properties of the parent and teacher versions of the Strengths and Difficulties Questionnaire. *Clinical Child and Family Psychology Review, 13,* 254-274.

Weigel, D. J., Martin, S. S., & Bennett, K. K. (2006). Contributions of the home literacy environment to preschool-aged children's emerging literacy and language skills. *Early Child Development and Care*, *176*, 357-378.

Weiland, C., & Yoshikawa, H. (2013). Impacts of a prekindergarten program on children's mathematics, language, literacy, executive function, and emotional skills. *Child Development*, *84*, 2112-2130. doi:10.1111/cdev.12099

Yates, T., Ostrosky, M., Cheatham, G., Fettig, A., Shaffer, L., & Milagros Santos, R. (2008). *Research synthesis on screening and assessing social-emotional competence.* Center on the Social Emotional Foundations for Early Learning. Retrieved from http://csefel.vanderbilt.edu/documents/rs_screening_assessment.pdf

Yoshikawa, H., Weiland, C., & Brooks-Gunn, J. (2016). When does preschool matter? *The Future of Children*, *26*, 21-35.

Zimmerman, F. J., Christakis, D. A., & Meltzoff, A. N. (2007). Television and DVD/video viewing in children younger than 2 years. *Archives of Pediatrics & Adolescent Medicine*, *161*, 473-479. doi:10.1001/archpedi.161.5.473

Ziol-Guest, K. M., & McKenna, C. C. (2014). Early childhood housing instability and school readiness. *Child Development*, *85*, 103-113. doi:10.1111/cdev.12105

Ziv, Y. (2013). Social information processing patterns, social skills, and school readiness in preschool children. *Journal of Experimental Child Psychology*, *114*, 306-320. doi:10.1016/j.jecp.2012.08.009

Table 1

Descriptive statistics for screening measures.

	N	Minimum	Maximum	Mean	Std. Deviation
Brigance III	1181	0	86	47	14.9
Parent Survey	1177	0	16	6.7	4.0
Parent Interview	1177	0	8	2.1	1.2
Screener Observations Checklist	1180	0	22	1.9	2.8

Note: High scores on the Brigance III indicate stronger functioning. High scores on the parent survey, parent interview, and screener observations indicate higher levels of risk.

Table 2

Item-level descriptive statistics: Parent interview and screener observations checklist.

	N	Minimum	Maximum	Mean	Std. Deviation
Parent Interview					
Screen Time	1179	0	2	1.14	.72
Reading to the child	1180	0	1	.37	.48
Parental social support	1180	0	1	.28	.45
Parent-child activities	1180	0	1	.00	.07
Developmental concerns	1176	0	4	.62	.81
Exposure to domestic violence	1177	0	1	.03	.18
Screener Observations					
Auditory	1180	0	1	.02	.15
Vision	1180	0	1	.00	.07
Speech	1179	0	1	.37	.48
Self-Reliance	1180	0	3	.43	.75
Emotional Functioning	1180	0	4	.69	1.26
Motor Skills	1180	0	1	.09	.29
Physical Appearance	1180	0	1	.01	.08

Note: All screening variables are coded such that higher scores indicate greater risk. For example, a score of one for "Reading to the child" suggests that parents read to their child less than three times per week. Items have been modified for this table. The screener observations checklist and parent interview may be found in Appendix A and B, respectively, which can provide information about the full items and potential responses.

Table 3

Descriptive statistics for pre-kindergarten indicators of functioning.

	N	Minimum	Maximum	Mean	Std. Deviation
PPVT Scores	1282	20	135	82.9	17.5
Total Protective Factors	1146	28	72	49.3	9.3
Behavior Concerns	1146	28	72	49.0	9.5

Note: PPVT Scores represents scores on the Peabody Picture Vocabulary Test, a measure of receptive vocabulary. Total Protective Factors and Behavior Concerns are subscales of the Devereux Early Childhood Assessment measuring social-emotional strengths (Total Protective Factors) and behavior challenges as assessed by the child's teacher.

Table 4

Correlations between screening measures and pre-kindergarten indicators of functioning.

	PPVT Scores	DECA: Total Protective Factors	DECA: Behavior Concerns
Brigance III	.41*	.25*	-.17*
Parent Interview	.00	-.18*	.14*
Screen Time	.19*	-.02	.04
Reading to child	-.21*	-.05	-.02
Parental social support	-.12*	.00	-.03
Parent-child activities	-.05	-.01	.02
Developmental concerns	.08*	-.16*	.19*
Exposure to domestic violence	.03	-.01	.04
Screener Observations	-.19*	-.29*	.27*
Auditory	-.07*	-.10*	.06
Vision	-.01	-.02	-.01
Speech	-.07*	-.20*	.20*
Self-Reliance	-.20*	-.21*	.18*
Emotional Functioning	-.18*	-.27*	.26*
Motor Skills	-.08*	-.18*	.17*
Physical Appearance	.04	-.02	.00
Parent Survey	.06	-.11*	.14*

Note: All screening variables (except for the Brigance) are coded such that higher scores indicate greater risk. For example, a score of one for "Reading to child" suggests that parents read to their child less than three times per week. The screener observations checklist and parent interview may be found in Appendix A and B, respectively, which can provide information about the full items and potential responses. For PPVT scores and DECA Total Protective Factors scores, higher scores indicate better functioning. On the DECA Behavior Concerns Scale, lower scores indicate better functioning. *$p < .05$.

Table 5

Hierarchical multiple regression using screening scale scores to predict PPVT scores.

Model		*b*	*95% CI*	*B*	R^2	ΔR^2	ΔF
Step 1					.23	.23*	69.35*
	(Intercept)	72.93*	71.05 - 74.81				
	African American	15.28*	13.19 - 17.37	.42*			
	American Indian	-.02	-13.73 - 13.69	.00			
	Asian	-3.24	-7.09 - 0.62	-.05			
	Multi-Racial	13.14*	6.14 - 20.14	.10*			
	White	16.46*	12.45 - 20.47	.23*			
	Gender (Female)	1.08	-0.84 - 3.00	.03			
	Per Person Income	.36*	0.23 - 0.50	.15*			
Step 2					.35	.12*	190.70*
	(Intercept)	54.62*	51.50 - 57.75				
	Brigance	.43*	.37 - .50	.36*			
Step 3					.36	.01*	5.17*
	(Intercept)	54.07*	50.03 - 58.10				
	Parent Survey	.18	-.05 - .41	.04			
	Parent Interview	.80*	.01 - 1.59	.06*			
	Screener Observ.	-.59*	-.96 - -.22	-.09*			

Note: Hispanic is the reference group for race/ethnicity entered in step 1. Per Person Income is coded such that a one unit increase in the variable indicates a $1000 increase in per person income. *$p < .05$.

Table 6
Hierarchical multiple regression using screening item scores to predict PPVT scores.

Model		*b*	*95% CI*	*B*	R^2	ΔR^2	ΔF
Step 1					.23	.23	44.34*
	(Intercept)	72.89*	71.01 - 74.78				
	African American	15.39*	13.30 - 17.49	.42*			
	American Indian	.03	-13.69 - 13.74	.00			
	Asian	-3.18	-7.04 - .68	-.05			
	Multi-Racial	13.19*	6.19 - 20.19	.10*			
	White	16.46*	12.42 - 20.50	.23*			
	Gender (Female)	1.05	-.88 - 2.97	.03			
	Per Person Income	.36*	.23 - .50	.15*			
Step 2					.35	.12*	192.89*
	(Intercept)	54.31*	51.16 - 57.45				
	Brigance	.43*	.37 - .49	.36*			
Step 3					.35	.01*	2.09*
	(Intercept)	56.63*	52.91 - 60.36				
	Hearing Concerns	.00	-5.92 - 5.93	.00			
	Vision Concerns	-5.31	-19.36 - 8.74	-.02			
	Speech Concerns	.42	-1.61 - 2.46	.01			
	Self-Reliance Concerns	-1.28	-2.93 - .38	-.05			
	Emot. Func. Concerns	-.44	-1.40 - .52	-.03			
	Motor Skills Concerns	-2.22	-5.48 - 1.03	-.04			
	Physical Appearance	11.49	.03 - 22.95	.05			
Step 4					.37	.02*	4.41
	(Intercept)	55.91*	51.81 - 60.01				
	Screen Time	1.77*	.48 - 3.06	.07*			
	Reading to Child	-2.25*	-4.12 - -.39	-.06*			
	Social Support	-.31	-2.30 - 1.68	-.01			
	P-C Activities	-9.77	-22.25 - 2.70	-.04			
	Develop. Concerns	1.76*	.55 - 2.97	.08*			
	Domestic Violence	3.78	-1.34 - 8.90	.04			
Step 5					.37	.00	2.53
	(Intercept)	55.02*	50.77 - 59.26				
	Parent Survey	.19	-.04 - .43	.04			

Note: All screening variables (except for the Brigance) are coded such that higher scores indicate greater risk. Emot. Func. represents emotional functioning. P-C Activities represents parent-child activities. The screener observations checklist and parent interview may be found in Appendix A and B, respectively. Hispanic is the reference group for race/ethnicity entered in step 1. Per person income is measured in $1000 units. P-C Activities indicates parent-child activities. * indicates significance at $p < .05$.

Table 7

Unstandardized and standardized regression coefficients for all variables in step 5 of the hierarchical multiple regression predicting PPVT scores.

Model	*b*	95% CI	*B*	R^2	ΔR^2	ΔF
Step 5				.37	.00	3.89
(Intercept)	55.02	50.77 - 59.26				
African American	11.88*	9.78 - 13.99	.33*			
American Indian	.50	-12.19 - 13.19	.00			
Asian	-2.57	-6.13 - .99	-.04			
Multi-Racial	9.88*	3.49 - 16.27	.08*			
White	12.62*	8.82 - 16.43	.18*			
Gender (Female)	.25	-1.53 - 2.02	.01			
Per Person Income	.28*	.15 - .40	.11*			
Brigance	.39*	.32 - .46	.32*			
Hearing Concerns	-.71	-6.59 - 5.17	-.01			
Vision Concerns	-5.12	-19.04 - 8.81	-.02			
Speech Concerns	-.67	-2.76 - 1.41	-.02			
Self-Reliance Concerns	-.82	-2.46 - .82	-.03			
Emot. Func. Concerns	-.78	-1.75 - .18	-.06			
Motor Skills Concerns	-3.13	-6.39 - .13	-.05			
Physical Appearance	10.38	-.98 - 21.75	.04			
Screen Time	1.75*	.46 - 3.04	.07*			
Reading to Child	-2.41*	-4.28 - -.54	-.07*			
Social Support	-.40	-2.39 - 1.59	-.01			
P-C Activities	-10.05	-22.52 - 2.42	-.04			
Develop. Concerns	1.49*	.23 - 2.74	.07*			
Domestic Violence	3.69	-1.42 - 8.81	.04			
Parent Survey	.19	-.04 - .43	.04			

Note: All screening variables (except for the Brigance) are coded such that higher scores indicate greater risk. Emot. Func. represents emotional functioning. P-C Activities represents parent-child activities. The screener observations checklist and parent interview may be found in Appendix A and B, respectively, which can provide information about the full items and potential responses. Hispanic is the reference group for race/ethnicity. Per Person Income is coded such that a one unit increase in the variable indicates a $1000 increase in per person income. P-C Activities indicates parent-child activities. * indicates significance at $p < .05$.

Table 8

Hierarchical multiple regression using screening scale scores to predict DECA Total Protective Factor scores.

Model		*b*	95% CI	*B*	R^2	ΔR^2	ΔF
Step 1					.04	.04*	6.36*
	(Intercept)	48.15*	47.03 - 49.27				
	African American	.16	-1.09 - 1.41	.01			
	American Indian	-6.33	-14.28 - 1.63	-.05			
	Asian	-1.52	-3.84 - .81	-.04			
	Multi-Racial	-1.50	-6.01 - 3.02	-.02			
	White	-.57	-2.90 - 1.77	-.02			
	Gender (Female)	3.76*	2.61 - 4.91	.20*			
	Per Person Income	.02	-.06 - .10	.02			
Step 2					.10	.06*	67.74*
	(Intercept)	41.26*	39.29 - 43.23				
	Brigance	.16*	.12 - .20	.26*			
Step 3					.15	.05*	18.45*
	(Intercept)	46.73*	44.27 - 49.20				
	Parent Survey	-.07	-.21 - .08	-.03			
	Parent Interview	-.63*	-1.11 - -.15	-.08*			
	Screener Observ.	-.65*	-.88 - -.43	-.20*			

Note: Hispanic is the reference group for race/ethnicity entered in step 1. Per Person Income is coded such that a one unit increase in the variable indicates a $1000 increase in per person income. * indicates significance at $p < .05$.

Table 9
Hierarchical regression using screening items to predict DECA Total Protective Factors.

Model		*b*	*95% CI*	*B*	R^2	ΔR^2	ΔF
Step 1					.03	.04	6.03*
	(Intercept)	48.14*	47.01 - 49.26				
	African American	.18	-1.07 - 1.44	.01			
	American Indian	-6.27	-14.25 - 1.72	-.05			
	Asian	-1.46	-3.80 - .87	-.04			
	Multi-Racial	-1.45	-5.98 - 3.08	-.02			
	White	-.57	-2.92 - 1.79	-.02			
	Gender (Female)	3.67*	2.52 - 4.83	.20*			
	Per Person Income	.02	-.06 - .11	.02			
Step 2					.10	.06*	67.86*
	(Intercept)	41.19*	39.21 - 43.18				
	Brigance	.16*	.12 - .20	.26*			
Step 3					.15	.06*	9.19*
	(Intercept)	45.62*	43.33 - 47.90				
	Hearing Concerns	-2.99	-6.59 - 0.60	-.05			
	Vision Concerns	-.59	-10.29 - 9.12	.00			
	Speech Concerns	-1.44*	-2.69 - -0.18	-.08*			
	Self-Reliance Concerns	.11	-.92 - 1.13	.01			
	Emot. Func. Concerns	-1.36*	-1.96 - -0.77	-.18*			
	Motor Skills Concerns	-2.89*	-4.91 - -0.87	-.09*			
	Physical Appearance	-2.24	-9.09 - 4.61	-.02			
Step 4					.15	.00	.72
	(Intercept)	45.96*	43.43 - 48.50				
	Screen Time	-.09	-.89 - .72	-.01			
	Reading to Child	-.43	-1.59 - .72	-.02			
	Social Support	.22	-1.00 - 1.45	.01			
	P-C Activities	-2.03	-10.44 - 6.37	-.01			
	Develop. Concerns	-.61	-1.36 - .13	-.05			
	Domestic Violence	1.30	-1.81 - 4.41	.02			
Step 5					.15	.00	.69
	(Intercept)	46.25*	43.62 - 48.87				
	Parent Survey	-.06	-.21 - .08	-.03			

Note: All screening variables (except for the Brigance) are coded such that higher scores indicate greater risk. Emot. Func. represents emotional functioning. P-C Activities represents parent-child activities. The screener observations checklist and parent interview may be found in Appendix A and B, respectively. Hispanic is the reference group for race/ethnicity entered in step 1. Per person income is measured in $1000 units. P-C Activities indicates parent-child activities. * indicates significance at $p < .05$.

Table 10

Unstandardized and standardized regression coefficients for all variables in step 5 of the hierarchical multiple regression predicting DECA Total Protective Factors scores.

Model	*b*	95% CI	*B*	R^2	ΔR^2	ΔF
Step 5				.15	.00	.69
(Intercept)	46.25*	43.62 - 48.87				
African American	-.05	-1.36 - 1.26	.00			
American Indian	1.30	-6.48 - 9.08	.01			
Asian	-1.00	-3.23 - 1.23	-.03			
Multi-Racial	-2.20	-6.49 - 2.09	-.03			
White	.02	-2.30 - 2.35	.00			
Gender (Female)	2.85*	1.75 - 3.95	.15*			
Per Person Income	.03	-.05 - .11	.02			
Brigance	.10*	.06 - .14	.16*			
Hearing Concerns	-2.86	-6.48 - .75	-.05			
Vision Concerns	-.26	-9.99 - 9.47	.00			
Speech Concerns	-1.20	-2.50 - .10	-.06			
Self-Reliance Concerns	.10	-.94 - 1.13	.01			
Emot. Func. Concerns	-1.31*	-1.92 - -.70	-.18*			
Motor Skills Concerns	-2.65*	-4.69 - -.61	-.08*			
Physical Appearance	-1.84	-8.72 - 5.04	-.02			
Screen Time	-.08	-.88 - .73	-.01			
Reading to Child	-.38	-1.54 - .78	-.02			
Social Support	.25	-.97 - 1.48	.01			
P-C Activities	-1.89	-10.30 - 6.52	-.01			
Develop. Concerns	-.52	-1.30 - .25	-.05			
Domestic Violence	1.33	-1.78 - 4.43	.03			
Parent Survey	-.06	-.21 - .08	-.03			

Note: All screening variables (except for the Brigance) are coded such that higher scores indicate greater risk. Emot. Func. represents emotional functioning. P-C Activities represents parent-child activities. The screener observations checklist and parent interview may be found in Appendix A and B, respectively, which can provide information about the full items and potential responses. Hispanic is the reference group for race/ethnicity. Per person income is measured in $1000 units. P-C Activities indicates parent-child activities. * indicates significance at $p < .05$.

Table 11

Hierarchical multiple regression using screening scale scores to predict DECA Behavior Concerns scores.

Model		*b*	95% CI	*B*	R^2	ΔR^2	ΔF
Step 1					.05	.06*	8.77*
	(Intercept)	49.82*	48.66 - 50.97				
	African American	1.21	-.07 - 2.50	.06			
	American Indian	7.66	-.53 - 15.85	.06			
	Asian	1.31	-1.08 - 3.70	.04			
	Multi-Racial	3.31	-1.34 - 7.96	.04			
	White	2.46*	.06 - 4.86	.07*			
	Gender (Female)	-4.30*	-5.48 - -3.12	-.22*			
	Per Person Income	-.02	-.10 - .06	-.02			
Step 2					.07	.02*	24.25*
	(Intercept)	54.15*	52.08 - 56.23				
	Brigance	-.10*	-.14 - -.06	-.16*			
Step 3					.12	.05*	18.54*
	(Intercept)	48.44*	45.85 - 51.04				
	Parent Survey	.15	-.01 - .30	.06			
	Parent Interview	.34	-.17 - .85	.04			
	Screener Observ.	.73*	.49 - .97	.21*			

Note: Hispanic is the reference group for race/ethnicity entered in step 1. Per Person Income is coded such that a one unit increase in the variable indicates a $1000 increase in per person income. * $p < .05$.

Table 12
Hierarchical regression using screening items to predict DECA Behavior Concerns.

Model	*b*	*95% CI*	*B*	R^2	ΔR^2	ΔF
Step 1				.05	.06	8.56*
(Intercept)	49.87*	48.71 - 51.02				
African American	1.21	-.08 - 2.50	.06			
American Indian	7.60	-.59 - 15.80	.06			
Asian	1.28	-1.12 - 3.67	.03			
Multi-Racial	3.28	-1.37 - 7.93	.04			
White	2.49*	.07 - 4.91	.07*			
Gender (Female)	-4.26*	-5.44 - -3.07	-.22*			
Per Person Income	-.02	-.11 - .06	-.02			
Step 2				.07	.02*	23.94*
(Intercept)	54.19*	52.11 - 56.27				
Brigance	-.10*	-.14 - -.06	-.15*			
Step 3				.13	.06*	10.36*
(Intercept)	49.49*	47.10 - 51.87				
Hearing Concerns	1.28	-2.48 - 5.04	.02			
Vision Concerns	-5.28	-15.42 - 4.86	-.03			
Speech Concerns	1.95*	.64 - 3.26	.10*			
Self-Reliance Concerns	-.55	-1.62 - .53	-.04			
Emot. Func. Concerns	1.72*	1.10 - 2.35	.22*			
Motor Skills Concerns	2.66*	.55 - 4.77	.08*			
Physical Appearance	.59	-6.58 - 7.75	.00			
Step 4				.14	.01	1.50
(Intercept)	49.40*	46.76 - 52.05				
Screen Time	.26	-.58 - 1.10	.02			
Reading to Child	-.47	-1.67 - .74	-.02			
Social Support	-.59	-1.87 - .69	-.03			
P-C Activities	3.81	-4.95 - 12.58	.03			
Develop. Concerns	.97*	.19 - 1.75	.08*			
Domestic Violence	.87	-2.37 - 4.11	.02			
Step 5				.14	.00	1.93
(Intercept)	48.90*	46.17 - 51.64				
Parent Survey	.11	-.04 - .26	.05			

Note: All screening variables (except for the Brigance) are coded such that higher scores indicate greater risk. Emot. Func. represents emotional functioning. P-C Activities represents parent-child activities. The screener observations checklist and parent interview may be found in Appendix A and B, respectively. Hispanic is the reference group for race/ethnicity entered in step 1. Per person income is measured in $1000 units. P-C Activities indicates parent-child activities. * indicates significance at $p < .05$.

Table 13

Unstandardized and standardized regression coefficients for all variables in step 5 of the hierarchical multiple regression predicting DECA Behavior Concerns scores.

Model	*b*	95% CI	*B*	R^2	ΔR^2	ΔF
Step 5				.14	.00	1.93
(Intercept)	48.90	46.17 - 51.64				
African American	.74	-0.62 - 2.10	.04			
American Indian	1.04	-7.07 - 9.15	.01			
Asian	.70	-1.62 - 3.03	.02			
Multi-Racial	3.43	-1.04 - 7.90	.05			
White	1.01	-1.41 - 3.43	.03			
Gender (Female)	-3.40*	-4.55 - -2.25	-.18*			
Per Person Income	-.04	-0.12 - 0.04	-.03			
Brigance	-.03	-0.08 - 0.01	-.05			
Hearing Concerns	.93	-2.83 - 4.70	.02			
Vision Concerns	-5.66	-15.79 - 4.48	-.03			
Speech Concerns	1.42*	0.07 - 2.78	.07*			
Self-Reliance Concerns	-.39	-1.47 - 0.69	-.03			
Emot. Func. Concerns	1.57*	0.94 - 2.21	.21*			
Motor Skills Concerns	2.23*	0.10 - 4.36	.07*			
Physical Appearance	.08	-7.09 - 7.25	.00			
Screen Time	.24	-0.60 - 1.08	.02			
Reading to Child	-.55	-1.76 - 0.66	-.03			
Social Support	-.64	-1.92 - 0.63	-.03			
P-C Activities	3.56	-5.21 - 12.33	.02			
Develop. Concerns	.81*	0.00 - 1.62	.07*			
Domestic Violence	.82	-2.42 - 4.06	.02			
Parent Survey	.11	-0.04 - 0.26	.05			

Note: All screening variables (except for the Brigance) are coded such that higher scores indicate greater risk. Emot. Func. represents emotional functioning. P-C Activities represents parent-child activities. The screener observations checklist and parent interview may be found in Appendix A and B, respectively, which can provide information about the full items and potential responses. Hispanic is the reference group for race/ethnicity. Per person income is measured in $1000 units. P-C Activities indicates parent-child activities. * indicates significance at $p < .05$.

Table 14
Descriptive statistics for the composite school readiness variable.

	N	Minimum	Maximum	Mean	Std. Deviation
School Readiness	1113.00	.25	97.36	56.26	15.00

Note: School readiness refers to a composite score composed of 50% PPVT scores, 25% DECA Total Protective Factors scores and 25% DECA Behavior Concerns scores.

Table 15

Hierarchical multiple regression using screening scale scores to predict school readiness at the beginning of pre-k.

Model		*b*	*95% CI*	*B*	R^2	ΔR^2	ΔF
Step 1					.17	.17*	214.00*
	(Intercept)	36.92*	13.14 - 18.69				
	Brigance	.42*	.36 - .47	.41*			
Step 2					.19	.02*	30.54*
	(Intercept)	41.77*	17.84 - 24.29				
	Brigance	.35*	.29 - .41	.34*			
	Screener Observ.	-.93*	-1.26 - -.60	-.17*			
Step 3					.19	.00	.03
	(Intercept)	41.89*	17.39 - 24.38				
	Brigance	.35*	.29 - .41	.34*			
	Screener Observ.	-.92*	-1.26 - -.58	-.17*			
	Parent Interview	-.06	-.75 - .64	-.00			
Step 4					.19	.00	.10
	(Intercept)	41.75*	17.15 - 24.35				
	Brigance	.35*	.29 - .41	.34*			
	Screener Observ.	-.93*	-1.27 - -.58	-.17*			
	Parent Interview	-.09	-.82 - .63	-.01			
	Parent Survey	.03	-.18 - .25	.01			

Note: * $p < .05$.

Table 16

Hierarchical multiple regression using Brigance scores and screening items to predict school readiness at the beginning of pre-k.

Model		*b*	95% CI	*B*	R^2	ΔR^2	ΔF
Step 1					.16	.16*	197.71*
	(Intercept)	37.75*	13.98 - 19.52				
	Brigance	.40*	.35 - .46	.40*			
Step 2					.19	.04*	7.25*
	(Intercept)	43.16*	18.84 - 25.48				
	Hearing Concerns	-2.83	-8.30 - 2.63	-.03			
	Vision Concerns	-.03	-13.20 - 13.13	.00			
	Speech Concerns	-.06	-1.08 - .95	.00			
	Self-Reliance Concerns	-1.05	-2.58 - .48	-.05			
	Emot. Func. Concerns	-1.63*	-2.53 - -.73	-.14*			
	Motor Skills Concerns	-3.95*	-6.96 - -.93	-.07*			
	Physical Appearance	7.30	-2.68 - 17.28	.04			
Step 3					.21	.03*	6.25*
	(Intercept)	43.50*	18.86 - 26.13				
	Screen Time	2.03*	.92 - 3.14	.10*			
	Reading to Child	-3.59*	-5.27 - -1.92	-.12			
	Social Support	-.76	-2.56 - 1.04	-.02			
	P-C Activities	-8.68	-21.65 - 4.29	-.04			
	Develop. Concerns	.78	-.32 - 1.88	.04			
	Domestic Violence	1.26	-3.27 - 5.80	.01			

Note: All screening variables (except for the Brigance) are coded such that higher scores indicate greater risk. Emot. Func. represents emotional functioning. P-C Activities represents parent-child activities. The screener observations checklist and parent interview may be found in Appendix A and B, respectively, which can provide information about the full items and potential responses. P-C Activities indicates parent-child activities. * indicates significance at $p < .05$.

Table 17

Final step of a Hierarchical multiple regression using Brigance scores and screening items to predict school readiness at the beginning of pre-k.

Model	*b*	*95% CI*	*B*	R^2	ΔR^2	ΔF
Step 3				.21	.03*	6.25*
(Intercept)	43.50*	18.86 - 26.13				
Brigance	.30*	.24 - .36	.30*			
Hearing Concerns	-3.31	-8.71 - 2.09	-.03			
Vision Concerns	-.62	-13.63 - 12.39	.00			
Speech Concerns	-.74	-1.81 - .33	-.04			
Self-Reliance Concerns	-.43	-1.95 - 1.10	-.02			
Emot. Func. Concerns	-1.92*	-2.82 - -1.02	-.16*			
Motor Skills Concerns	-4.77*	-7.77 - -1.77	-.09*			
Physical Appearance	6.23	-3.63 - 16.08	.03			
Screen Time	2.03*	.92 - 3.14	.10*			
Reading to Child	-3.59*	-5.27 - -1.92	-.12*			
Social Support	-.76	-2.56 - 1.04	-.02			
P-C Activities	-8.68	-21.65 - 4.29	-.04			
Develop. Concerns	.78	-.32 - 1.88	.04			
Domestic Violence	1.26	-3.27 - 5.80	.01			

Note: All screening variables (except for the Brigance) are coded such that higher scores indicate greater risk. For example, a score of one for "Reading to child" suggests that parents read to their child less than three times per week, which was marked as a risk factor. The screener observations checklist and parent interview may be found in Appendix A and B, respectively, which can provide information about the full items and potential responses. P-C Activities indicates parent-child activities. * indicates significance at $p < .05$.

Table 18

Hierarchical multiple regression using Brigance scores and screening items to predict school readiness at the beginning of pre-k.

Model		*b*	*95% CI*	*B*	R^2	ΔR^2	ΔF
Step 1					.16	.16*	197.97*
	(Intercept)	37.82*	14.06 - 19.58				
	Brigance	.40*	.35 - .46	.40*			
Step2					.19	.04*	8.23*
	(Intercept)	43.26*	18.95 - 25.56				
	Brigance	.33*	.27 - .39	.32*			
	Hearing Concerns	-2.64	-8.08 - 2.81	-.03			
	Vision Concerns	-.10	-13.25 - 13.04	.00			
	Speech Concerns	-.05	-1.06 - .96	.00			
	Self-Reliance Concerns	-1.05	-2.58 - .48	-.05			
	Emot. Func. Concerns	-1.64*	-2.54 - -.74	-.14*			
	Motor Skills Concerns	-3.86*	-6.86 - -.85	-.07*			
Step 3					.20	.02*	7.30*
	(Intercept)	45.76*	21.29 - 28.24				
	Brigance	.31*	.25 - .37	.31*			
	Hearing Concerns	-2.97	-8.37 - 2.43	-.03			
	Vision Concerns	-.64	-13.68 - 12.40	.00			
	Speech Concerns	-.27	-1.28 - .73	-.02			
	Self-Reliance Concerns	-.71	-2.24 - .81	-.04			
	Emot. Func. Concerns	-1.75*	-2.64 - -.85	-.14*			
	Motor Skills Concerns	-4.25*	-7.23 - -1.26	-.08*			
	Reading to Child	-3.61*	-5.28 - -1.94	-.12*			
	Social Support	-.94	-2.73 - .86	-.03			
	P-C Activities	-8.91	-21.93 - 4.11	-.04			

Note: Screening variables that had counter-intuitive coefficients in the previous analysis (i.e., Table 17) were excluded from this analysis. All screening variables (except for the Brigance) are coded such that higher scores indicate greater risk. Emot. Func. represents emotional functioning. P-C Activities represents parent-child activities. The screener observations checklist and parent interview may be found in Appendix A and B, respectively, which can provide information about the full items and potential responses. P-C Activities indicates parent-child activities. * indicates significance at $p < .05$.

Table 19

Estimation of the highest possible amount of variance in eligibility scores that could be explained by each predictor variable.

Brigance	45%
Emotional Functioning (SO)	19%
Hearing* (SO)	8%
Reading (PI)	6%
Domestic Violence* (PI)	4%
SDQ Behavior Problems	4%
Motor Skills (SO)	4%
P-C Activities (PI)	3%
SDQ Prosocial	2%
Other	6%
Total	100%

Note: *Denotes variables that are rarely endorsed. Other: Parental social support, parental concerns about development, parental concerns about school, parental mental health, vision, speech, and self-reliance (less than 2% each). SO denotes items assessed on the screener observations checklist. PI denotes items assessed on the parent interview. P-C Activities indicates parent-child activities. SDQ represents the Strengths and Difficulties Questionnaire.

Table 20
Estimated effects of each variable for a child with a high Brigance score.

	If 1 risk factor in that category applies	If all risk factors in that category apply
Emotional Functioning (SO)	4%	45%
Reading (PI)	8%	16%
Hearing* (SO)	6%	19%
SDQ Behavior Problems	2%	9%
Domestic Violence* (PI)	11%	11%
Motor Skills (SO)	4%	9%
P-C Activities (PI)	6%	6%
Self-Reliance (SO)	2%	5%
SDQ Prosocial	2%	4%
Other	6%	10%

*Denotes variables that are rarely endorsed. Other: Parental social support, parental concerns about development, parental concerns about school, parental mental health, vision, and speech (less than 4% each). SO denotes items assessed on the screener observations checklist. PI denotes items assessed on the parent interview. P-C Activities indicates parent-child activities. SDQ represents the Strengths and Difficulties Questionnaire.

Table 21
Amount of variance accounted for by revised and original eligibility scores.

	School Readiness	PPVT Scores	DECA TPF	DECA BC
Revised Eligibility Scores	.17	.13	.09	.05
Original Eligibility Scores	.13	.12	.06	.02

Appendix A: Screener Observations Checklist

Vision

___ held reading material far away or very close

___ showed symptoms of eye fatigue or stress (i.e., blinking, squinting, itching, tearing)

___ tended to close or squint one eye in order to see better

Total Possible Points: 3

Speech

___ had difficulty with articulation (omission, substitution, distortion)

___ voice quality (raspy, breathy, nasal, high-pitched, low-pitched)

___ oral expression appeared to be limited or inhibited

Total Possible Points: 3

Auditory (Hearing)

___ frequently misunderstood instructions (or asked that instructions be repeated)

___ needed to watch speaker's face closely to understand

___ turned head to one side in order to favor one ear

Total Possible Points: 3

Self-Reliance

___ lacked confidence/needed encouragement in order to perform

___ overly concerned about failure

___ was careless

Total Possible Points: 3

Emotional Functioning

___ appeared to be emotionally distressed

___ had difficulty cooperating

___ became impatient when presented with difficult task

___ tended to be very active

___ rapport was difficult to achieve and maintain

___ responded impulsively

___ had short-attention span for age

___ exhibited nervous habits or symptoms

Total Possible Points: 8

Motor Skills

___ gross motor skills appeared to be below age

___ fine motor skills appeared to be below age

Total Possible Points: 2

Physical Appearance

___ appeared to lack good physical health

Total Possible Points: 1

Appendix B: Parent Interview

Instructions read to the parent: *I am about to ask you a series of questions to give us some additional information about your child and family. All of these answers will be kept confidential.*

How much TV, iPad, cell phone or other technology device does your child watch and/or use each day?

___ 0-1 hours

___ 2-3 hours

___ 4 or more hours

Scoring (Bright Beginnings): 0-1 hours = 0 points; 2-3 hours or 4 or more hours = 1 point

*Scoring for analysis: 0-1 hours = 0 points; 2-3 hours = 1 point, 4 or more hours = 2 points

Do you read to your child every day/night?

___ Yes

___ No

Scoring: Yes = 0; No = 1

Do you have anybody to help you care for your child?

___ Yes

___ No

Scoring: Yes = 0; No = 1

What kind of activities do you and your child enjoy together?

(Open Response)

Scoring: No response = 1; Any activities mentioned = 0

Please tell me any concerns you have about the way your child is learning, developing or behaving?

(Open Response)

Scoring (Bright Beginnings): No response = 0; Any concerns mentioned = 1

*Scoring for analysis: No response = 0; 1 concern mentioned = 1 point; 2 concerns mentioned = 2 points; 3 concerns mentioned = 3 points; 4+ concerns mentioned = 4 points

Has your child been exposed to domestic violence in the home or neighborhood?

___ Yes

___ No

Scoring: Yes = 1; No = 0

Do you have any concerns regarding your child's past or current experiences in a pre school or child care setting?

(Open Response)

Scoring (Bright Beginnings): No response = 0; Any concerns mentioned = 1

**Data not available for the current study

Parent reports or appears to be distressed, sad, angry, depressed or have high levels of anxiety.

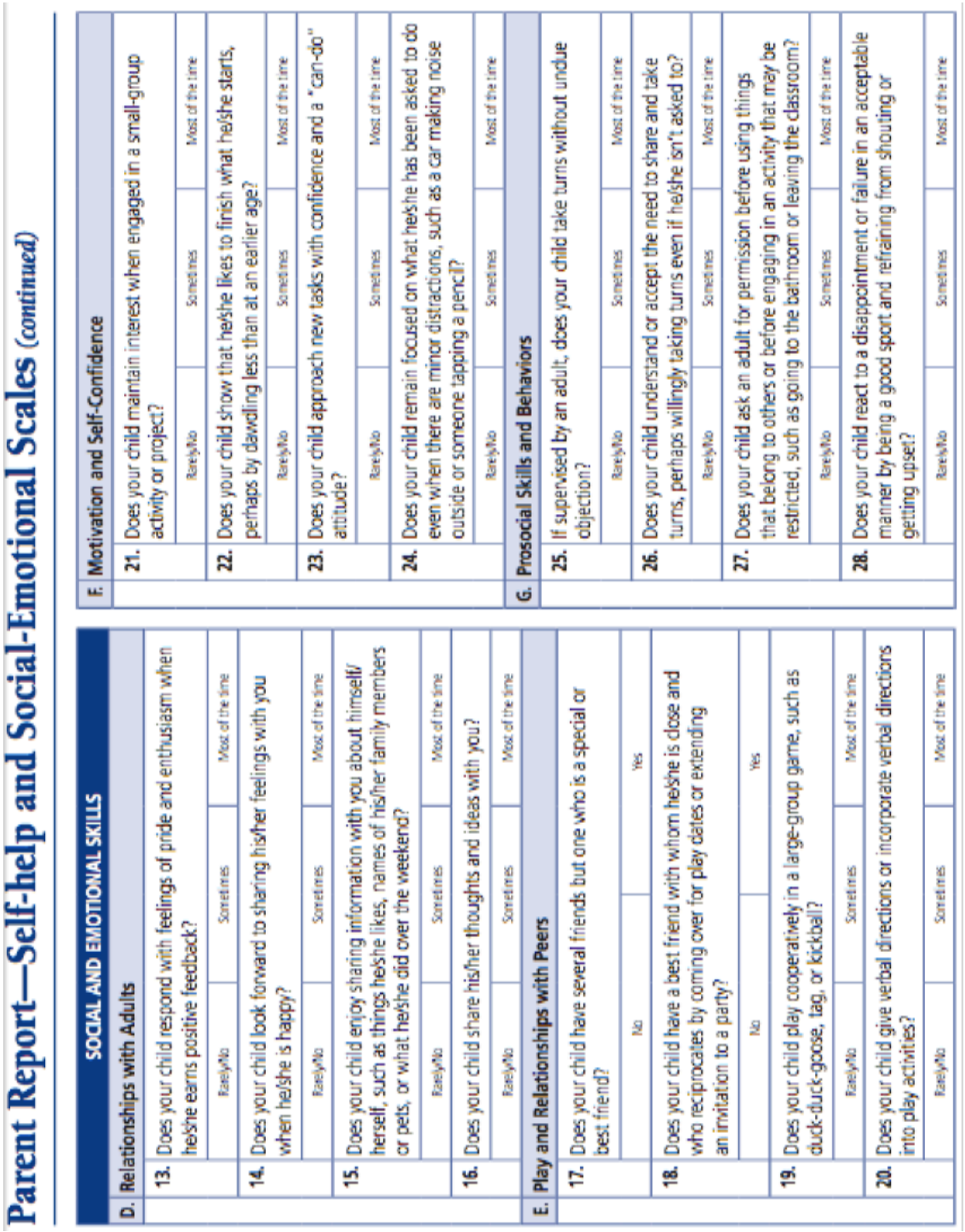
___ Yes

___ No

Scoring: Yes = 0; No = 1

**Data not available for the current study

Appendix C: Parent Survey (©Curriculum Associates, LLC)



Parent Report—Self-help and Social-Emotional Scales *(continued)*

SOCIAL AND EMOTIONAL SKILLS

D. Relationships with Adults

13. Does your child respond with feelings of pride and enthusiasm when he/she earns positive feedback?
Rarely/No | Sometimes | Most of the time

14. Does your child look forward to sharing his/her feelings with you when he/she is happy?
Rarely/No | Sometimes | Most of the time

15. Does your child enjoy sharing information with you about himself/herself, such as things he/she likes, names of his/her family members or pets, or what he/she did over the weekend?
Rarely/No | Sometimes | Most of the time

16. Does your child share his/her thoughts and ideas with you?
Rarely/No | Sometimes | Most of the time

E. Play and Relationships with Peers

17. Does your child have several friends but one who is a special or best friend?
No | Yes

18. Does your child have a best friend with whom he/she is close and who reciprocates by coming over for play dates or extending an invitation to a party?
No | Yes

19. Does your child play cooperatively in a large-group game, such as duck-duck-goose, tag, or kickball?
Rarely/No | Sometimes | Most of the time

20. Does your child give verbal directions or incorporate verbal directions into play activities?
Rarely/No | Sometimes | Most of the time

F. Motivation and Self-Confidence

21. Does your child maintain interest when engaged in a small-group activity or project?
Rarely/No | Sometimes | Most of the time

22. Does your child show that he/she likes to finish what he/she starts, perhaps by dawdling less than at an earlier age?
Rarely/No | Sometimes | Most of the time

23. Does your child approach new tasks with confidence and a "can-do" attitude?
Rarely/No | Sometimes | Most of the time

24. Does your child remain focused on what he/she has been asked to do even when there are minor distractions, such as a car making noise outside or someone tapping a pencil?
Rarely/No | Sometimes | Most of the time

G. Prosocial Skills and Behaviors

25. If supervised by an adult, does your child take turns without undue objection?
Rarely/No | Sometimes | Most of the time

26. Does your child understand or accept the need to share and take turns, perhaps willingly taking turns even if he/she isn't asked to?
Rarely/No | Sometimes | Most of the time

27. Does your child ask an adult for permission before using things that belong to others or before engaging in an activity that may be restricted, such as going to the bathroom or leaving the classroom?
Rarely/No | Sometimes | Most of the time

28. Does your child react to a disappointment or failure in an acceptable manner by being a good sport and refraining from shouting or getting upset?
Rarely/No | Sometimes | Most of the time

Curriculum Associates (n.d.). *Parent Report: Self-help and social-emotional Scales.* Curriculum Associates. Retrieved from http://www.casamples.com/downloads/BRIGANCE-K1-SHSES_Parent_English.pdf

Appendix D: Comparison of Eligibility Formulas

Based on 17-18 Formula			
Rank	Last Name	First Name	Eligibility Score
1	Student 1	Student 1	-2.50
2	Student 2	Student 2	-2.50
3	Student 3	Student 3	-2.50
4	Student 4	Student 4	-1.60
5	Student 5	Student 5	17.05
6	Student 6	Student 6	17.14
7	Student 7	Student 7	24.41
8	Student 8	Student 8	24.44
9	Student 9	Student 9	24.46
10	Student 10	Student 10	24.46
11	Student 11	Student 11	24.47
12	Student 12	Student 12	26.70
13	Student 13	Student 13	26.77
14	Student 14	Student 14	26.80
15	Student 15	Student 15	26.80
16	Student 16	Student 16	26.83
17	Student 17	Student 17	26.84
18	Student 18	Student 18	26.94
19	Student 19	Student 19	27.01
20	Student 20	Student 20	27.03
21	Student 21	Student 21	27.07
22	Student 22	Student 22	28.27
23	Student 23	Student 23	28.31
24	Student 24	Student 24	29.38
25	Student 25	Student 25	33.69
26	Student 26	Student 26	34.81
27	Student 27	Student 27	38.50
28	Student 28	Student 28	38.54
29	Student 29	Student 29	38.60
30	Student 30	Student 30	38.63
31	Student 31	Student 31	38.77
32	Student 32	Student 32	38.80
33	Student 33	Student 33	38.80
34	Student 34	Student 34	38.83
35	Student 35	Student 35	39.30
36	Student 36	Student 36	40.70
37	Student 37	Student 37	40.70
38	Student 38	Student 38	40.93
39	Student 39	Student 39	41.10
40	Student 40	Student 40	42.10

Based on Suggested Formula				
Rank_New	Change	Last Name	First Name	Eligibility Score
1	2	Student 3	Student 3	-0.65
2	0	Student 2	Student 2	8.62
3	18	Student 21	Student 21	8.94
4	7	Student 11	Student 11	9.23
5	-1	Student 4	Student 4	10.15
6	-5	Student 1	Student 1	10.58
7	-2	Student 5	Student 5	10.75
8	26	Student 34	Student 34	16.32
9	10	Student 19	Student 19	19.01
10	-4	Student 6	Student 6	19.20
11	3	Student 14	Student 14	19.57
12	10	Student 22	Student 22	20.35
13	26	Student 39	Student 39	20.45
14	10	Student 24	Student 24	21.00
15	37	Student 52	Student 52	21.40
16	-9	Student 7	Student 7	21.67
17	54	Student 71	Student 71	21.92
18	22	Student 40	Student 40	22.04
19	40	Student 59	Student 59	22.36
20	-10	Student 10	Student 10	23.17
21	2	Student 23	Student 23	23.22
22	8	Student 30	Student 30	23.79
23	33	Student 56	Student 56	24.73
24	-4	Student 20	Student 20	25.23
25	37	Student 62	Student 62	25.43
26	-10	Student 16	Student 16	25.71
27	17	Student 44	Student 44	25.78
28	27	Student 55	Student 55	26.16
29	22	Student 51	Student 51	26.53
30	-21	Student 9	Student 9	26.79
31	15	Student 46	Student 46	27.40
32	48	Student 80	Student 80	28.10
33	0	Student 33	Student 33	28.49
34	36	Student 70	Student 70	28.51
35	-6	Student 29	Student 29	28.85
36	-10	Student 26	Student 26	29.14
37	28	Student 65	Student 65	29.16
38	38	Student 76	Student 76	29.19
39	-26	Student 13	Student 13	29.65
40	-28	Student 12	Student 12	30.29

Note: Green indicates a student who moved up the list by at least 20 spots, based on the revised eligibility formula. Red indicates the student moved down the list by at least 20 spots, based on the revised eligibility formula.

41	Student 41	Student 41	42.10	41	-23	Student 18	Student 18	30.77
42	Student 42	Student 42	45.60	42	-27	Student 15	Student 15	30.85
43	Student 43	Student 43	45.62	43	-6	Student 37	Student 37	31.07
44	Student 44	Student 44	46.12	44	-8	Student 36	Student 36	31.20
45	Student 45	Student 45	46.14	45	-28	Student 17	Student 17	31.55
46	Student 46	Student 46	46.15	46	29	Student 75	Student 75	31.62
47	Student 47	Student 47	47.97	47	-4	Student 43	Student 43	31.62
48	Student 48	Student 48	47.99	48	-3	Student 45	Student 45	31.62
49	Student 49	Student 49	48.69	49	-18	Student 31	Student 31	31.66
50	Student 50	Student 50	48.69	50	-42	Student 8	Student 8	32.23
51	Student 51	Student 51	48.70	51	23	Student 74	Student 74	32.78
52	Student 52	Student 52	49.23	52	8	Student 60	Student 60	32.79
53	Student 53	Student 53	49.30	53	-21	Student 32	Student 32	32.97
54	Student 54	Student 54	49.73	54	42	Student 96	Student 96	33.05
55	Student 55	Student 55	49.73	55	-14	Student 41	Student 41	33.14
56	Student 56	Student 56	49.73	56	44	Student 100	Student 10(	33.26
57	Student 57	Student 57	50.10	57	-30	Student 27	Student 27	33.36
58	Student 58	Student 58	50.10	58	-33	Student 25	Student 25	33.37
59	Student 59	Student 59	50.13	59	-17	Student 42	Student 42	33.74
60	Student 60	Student 60	50.19	60	-32	Student 28	Student 28	33.95
61	Student 61	Student 61	50.96	61	-26	Student 35	Student 35	34.16
62	Student 62	Student 62	51.03	62	15	Student 77	Student 77	34.19
63	Student 63	Student 63	51.20	63	4	Student 67	Student 67	34.63
64	Student 64	Student 64	51.20	64	-10	Student 54	Student 54	34.89
65	Student 65	Student 65	51.63	65	-17	Student 48	Student 48	35.03
66	Student 66	Student 66	51.65	66	7	Student 73	Student 73	35.03
67	Student 67	Student 67	52.03	67	-6	Student 61	Student 61	35.04
68	Student 68	Student 68	53.00	68	29	Student 97	Student 97	35.28
69	Student 69	Student 69	53.00	69	-12	Student 57	Student 57	35.45
70	Student 70	Student 70	53.00	70	29	Student 99	Student 99	35.78
71	Student 71	Student 71	53.01	71	17	Student 88	Student 88	36.37
72	Student 72	Student 72	54.50	72	32	Student 104	Student 10	36.37
73	Student 73	Student 73	55.37	73	21	Student 94	Student 94	36.73
74	Student 74	Student 74	55.64	74	-5	Student 69	Student 69	36.74
75	Student 75	Student 75	57.05	75	-17	Student 58	Student 58	37.05
76	Student 76	Student 76	57.05	76	-23	Student 53	Student 53	37.20
77	Student 77	Student 77	57.05	77	-11	Student 66	Student 66	37.42
78	Student 78	Student 78	57.40	78	-15	Student 63	Student 63	37.58
79	Student 79	Student 79	57.40	79	12	Student 91	Student 91	37.67
80	Student 80	Student 80	60.45	80	-42	Student 38	Student 38	38.49

Note: Green indicates a student who moved up the list by at least 20 spots, based on the revised eligibility formula. Red indicates the student moved down the list by at least 20 spots, based on the revised eligibility formula.

81	Student 81	Student 81	72.00	81	-13	Student 68	Student 68	38.59
82	Student 82	Student 82	72.00	82	-33	Student 49	Student 49	38.64
83	Student 83	Student 83	72.00	83	-33	Student 50	Student 50	38.64
84	Student 84	Student 84	72.02	84	18	Student 102	Student 10	38.91
85	Student 85	Student 85	72.07	85	5	Student 90	Student 90	39.37
86	Student 86	Student 86	72.07	86	-39	Student 47	Student 47	39.38
87	Student 87	Student 87	72.08	87	14	Student 101	Student 10	39.67
88	Student 88	Student 88	72.08	88	-9	Student 79	Student 79	39.98
89	Student 89	Student 89	72.08	89	-2	Student 87	Student 87	40.97
90	Student 90	Student 90	72.08	90	-26	Student 64	Student 64	41.21
91	Student 91	Student 91	72.08	91	-19	Student 72	Student 72	41.36
92	Student 92	Student 92	72.09	92	-6	Student 86	Student 86	41.80
93	Student 93	Student 93	72.10	93	-15	Student 78	Student 78	41.91
94	Student 94	Student 94	72.15	94	-5	Student 89	Student 89	42.67
95	Student 95	Student 95	72.17	95	12	Student 107	Student 10	42.84
96	Student 96	Student 96	72.18	96	-14	Student 82	Student 82	43.11
97	Student 97	Student 97	72.18	97	-14	Student 83	Student 83	43.18
98	Student 98	Student 98	72.20	98	-14	Student 84	Student 84	43.87
99	Student 99	Student 99	76.79	99	6	Student 105	Student 10	44.13
100	Student 100	Student 100	76.79	100	8	Student 108	Student 10	44.61
101	Student 101	Student 101	76.83	101	-16	Student 85	Student 85	44.80
102	Student 102	Student 102	76.86	102	-9	Student 93	Student 93	44.80
103	Student 103	Student 103	79.00	103	-22	Student 81	Student 81	46.63
104	Student 104	Student 104	79.00	104	-12	Student 92	Student 92	47.25
105	Student 105	Student 105	79.00	105	-7	Student 98	Student 98	47.48
106	Student 106	Student 106	101.36	106	-11	Student 95	Student 95	48.41
107	Student 107	Student 107	101.36	107	-4	Student 103	Student 10	48.74
108	Student 108	Student 108	108.48	108	1	Student 109	Student 10	48.81
109	Student 109	Student 109	108.50	109	2	Student 111	Student 11	49.14
110	Student 110	Student 110	108.51	110	-4	Student 106	Student 10	50.05
111	Student 111	Student 111	125.21	111	-1	Student 110	Student 11	51.39
112	Student 112	Student 112	125.21	112	1	Student 113	Student 11	52.28
113	Student 113	Student 113	125.61	113	-1	Student 112	Student 11	53.22

Note: Green indicates a student who moved up the list by at least 20 spots, based on the revised eligibility formula. Red indicates the student moved down the list by at least 20 spots, based on the revised eligibility formula.